HABITAT

DAS BUCH

In standardisierter Form erhobene Verbreitungs- und Populationsdaten sind ein wichtiges Instrument für den Schutz und das Management von Tierarten und ihrer Lebensräume. Standardisierte Erhebungsmethoden sind darauf ausgerichtet verlässliche, vergleichbare und benutzerfreundliche Daten verfügbar zu machen und dadurch die Zeit- und Kosteneffizienz der Datenerhebung und –verarbeitung zu erhöhen.Der Riesenotter (*Pteronura brasiliensis*) ist ein bedrohtes Raubtier, das außerordentlich gut an das Leben in den aquatischen Lebensräumen der tropischen Niederungsgebiete Südamerikas angepasst ist. Seit den ersten Langzeitstudien am Riesenotter in den späten 1970er Jahren wurden Verbreitungserhebungen und Bestandzählungen in verschiedenen Ländern seines früheren und gegenwärtigen Verbreitungsgebietes durchgeführt – jedoch nicht in standardisierter Form und mit stark differierenden Interpretationen der Ergebnisse.Daher führte eine Arbeitsgruppe der IUCN/SSC Otter Specialist Group die praktische Erfahrung von mehr als 20 Riesenotterexperten aus allen südamerikanischen Ländern des gegenwärtigen Verbreitungsgebietes dieser Tierart zusammen. Als Ergebnis intensiver Diskussionen, Arbeitstagungen und Felderprobungen erarbeiteten sie die Grundlage für standardisierte Erhebungsmethoden.Diese beinhalten Richtlinien für Standard-Felderhebungs-methoden, für eine Standard-Verbreitungserhebungs-methode, für eine artarealweite Erhebungsstrategie und für Populationszählungen. Mittels dieser Instrumente wird eine verlässliche Grundlage für die Dokumentation der Verbreitung und die Einschätzung des Gefährdungsgrades des Riesenotters verfügbar gemacht.

THE BOOK

Distribution and population data collected in a standardised format is a valuable tool towards the protection and management of animal species and their habitats. Standardised survey methods are designed to provide reliable, comparable and user-friendly data, thereby increasing the time and cost efficiency of data gathering and processing.The giant otter (*Pteronura brasiliensis*) is an endangered carnivore, exceptionally well adapted to life in aquatic habitats in the tropical lowlands of South America. Since the first long-term giant otter studies in the late 1970s, distribution surveys and population censuses have been conducted in several countries of its former and present distribution range - but not in a standardised manner and with widely differing interpretations of results.Therefore, a taskforce of the IUCN/SSC Otter Specialist Group combined the practical experience of more than 20 giant otter specialists representing all South American countries within the species' current range of distribution. As a result of extensive discussions, workshops, and field tests they prepared the basis for standardised survey methodologies.These include guidelines for standard field survey techniques, for a standard distribution survey method, for a range-wide distribution survey strategy and for population censuses. By these tools a reliable basis for the documentation of the distribution and the estimation of the conservation status of the giant otter will be provide.

DIE AUTOREN

Die Erfahrung von 20 Autoren und Informanten aus 12 Ländern bildet den Hintergrund dieses Buches. Sie alle haben langfristige praktische Erfahrung aus einer großen Vielfalt von Riesenotter Forschungs- und Erhebungsprojekten. Einige von ihnen sind seit mehr als zwei Jahrzehnten in die wissenschaftliche und Naturschutz-Arbeit für diese Tierart eingebunden.Zusätzlich wurde die Erfahrung aus dem „Informations System Otter Sporen (ISOS)“ eingebunden. Diese GIS basierte Datenbank wurde im Jahr 200 von der deutschen Aktion Fischotterschutz e.V. eingerichtet, um Verbreitungsdaten des Eurasischen Fischotters zu erfassen und zu verarbeiten und wurde nun erweitert, um die Einbeziehung solcher Daten auch für den Riesenotter zu ermöglichen.Verantwortlich für die Leitung und Organisation des Entwicklungsprozesses für diese Richtlinien war Jessica Groendijk. Seit 1998 ist sie die Artkoordinatorin der IUCN/SSC Otter Specialist Group für den Riesenotter.

THE AUTHORS

The experience of 20 authors and contributors from 12 countries forms the background of this book. They all have long-term, practical experience gained during field work in a wide variety of giant otter research and survey projects. Some have been involved in scientific and conservation work with this species for more than two decades.Additional experience resulting from the 'Information System for Otter Surveys (ISOS)' was included. This GIS related databank was established in 2000 by the German Association for Otter Conservation [Aktion Fischotterschutz] to store and process distribution data of the Eurasian otter and has now been expanded to allow also the incorporation of such data on the giant otter.Responsible for supervision and organisation of the preparation process of these guidelines was Jessica Groenendijk. Since 1998, she is the Species Coordinator for the Giant Otter of the IUCN/SSC Otter Specialist Group.

HABITAT

Surveying and Monitoring Distribution and Population Trends of the Giant Otter (*Pteronura brasiliensis*)

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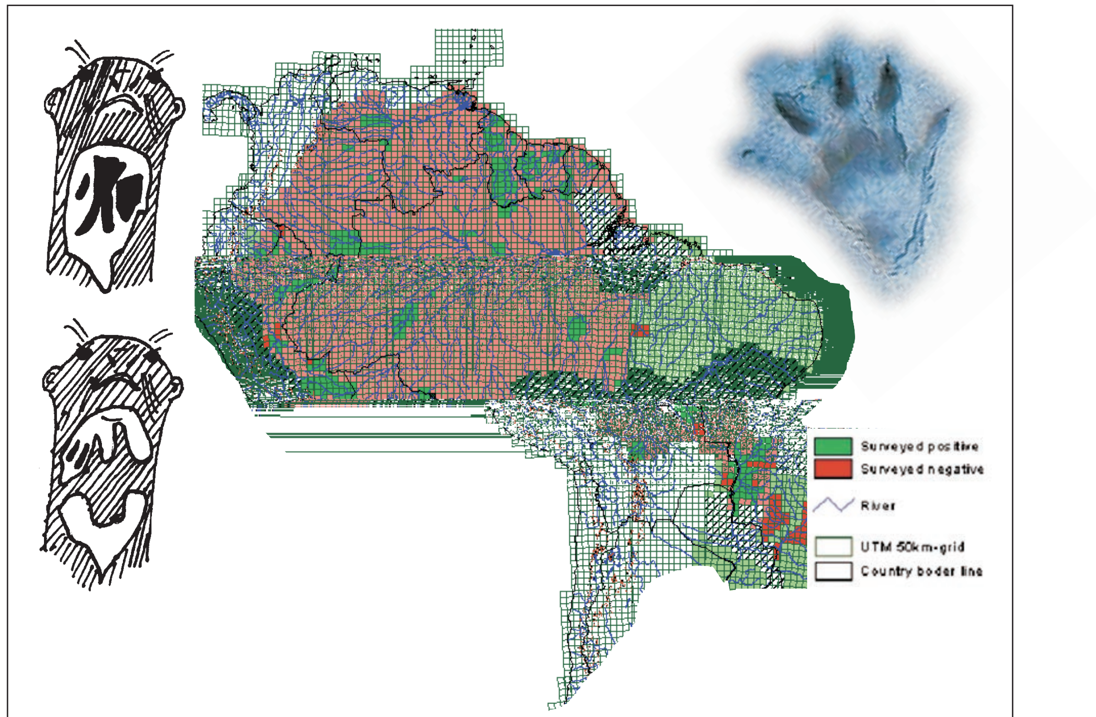

Surveying and Monitoring Distribution and Population Trends of the Giant Otter (*Pteronura brasiliensis*)

Guidelines for a Standardisation of Survey Methods
as recommended by the Giant Otter Section of the IUCN/SSC Otter Specialist Group

by
Jessica Groenendijk, Frank Hajek, Nicole Duplaix, Claus Reuther, Paul van Damme,
Christof Schenck, Elke Staib, Rob Wallace, Helen Waldemarin, Raphael Notin, Miriam Marmontel,
Fernando Rosas, Galia Ely de Mattos, Emanuela Evangelista, Victor Utreras, Geovanna Lasso,
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16

Surveying and Monitoring Distribution and Population Trends of the Giant Otter (*Pteronura brasiliensis*)

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Foreword

This publication represents important progress in the conservation of the giant otter (*Pteronura brasiliensis*) as well as for the work of the IUCN/SSC Otter Specialist Group. When introducing the standard for surveys on the Eurasian Otter (*Lutra lutra*) for Europe during the VIIIth International Otter Colloquium in Valdivia, Chile, in 2001, I lamented the fact that this was the only standardised survey method for otters so far. Using the example of the Red List assessments, I demonstrated the need for reliable distribution data gathered by comparable methods.

When I encouraged the members of the IUCN/SSC Otter Specialist Group to work on the development of such standards also for other otter species and other continents, I did not really expect results promptly. However, it seems that I underestimated the enthusiasm of the giant otter section of the Otter Specialist Group. Its coordinator, Jessica Groenendijk, used the long-term experience of the Giant Otter Research and Conservation Project of the Frankfurt Zoological Society in Peru as a basis for the development of standardised methods to survey and monitor distribution and population trends of this otter species. She succeeded in incorporating the knowledge of a remarkable number of giant otter researchers active throughout the species' range. In the process, an efficient network of experts working on the conservation of this species was established.

Though the giant otter is one of very few otter species allowing direct observations and individual identification, many basic questions regarding its conservation still remain open. It seems that its distribution range has decreased considerably, especially during the last century. However, as we do not know the exact extent of the remaining area inhabited by the giant otter we are unable to assess the magnitude of this decrease, the detailed conservation status of the species, and the effects of factors such as population fragmentation.

To be able to close these knowledge gaps, a reliable database is essential. This in turn requires such simple basics as unequivocal definitions of terms, but also uniform and comparable methods for gathering, processing, and assessing of data. This is what we call standardisation. Such a process not only improves the reliability of the database, but also increases the efficiency of research and conservation efforts.

Therefore, these first guidelines for standardised survey methods for monitoring distribution and population trends of the giant otter represent significant progress for the conservation of this species. However, it is not only the 'standard' itself which constitutes this progress. The above mentioned network of experts will lay the foundation for long-term giant otter conservation activities across national boundaries. Last but not least, the standard will offer the opportunity of a systematic and coordinated range-wide distribution survey strategy.

Nevertheless, the preparation of these guidelines only represents a first step. We have to be aware of the fact that they do not represent a final or even a state. This is not only because such a standardisation process always requires compromises to cover scientific demands as well as pragmatic considerations. It also needs to be understood as a dynamic process, moved forward by improvements resulting from each further survey. Therefore, any assistance provided by (otter) specialists involved in distribution mapping and biological research to further increase the efficiency of the methodology is welcomed.

Not only the improvement of the methodology will require additional effort. Its implementation represents the main challenge. This will need the cooperation of all people and institutions involved in the conservation of the giant otter. Such cooperation requires the application of the 'standard' in all future surveys, as well as the provision of organisational and financial resources.

However, at this stage I would like to thank all experts and institutions who enabled this groundbreaking step in giant otter conservation. Among the members of the IUCN/SSC Otter Specialist Group, my special thanks go to the Frankfurt Zoological Society for organising workshops and for financing the printing of these guidelines, to the Associación FaunAgua, the Instituto de Desenvolvimento Sustentavel Mamirauá and the Wildlife Conservation Society for organising additional workshops, and to the German Association for Otter Conservation [Aktion Fischotterschutz] for providing the the opportunity to incorporate the giant otter data in its 'Information System for Otter Surveys (ISOS)'.

I would be glad if this report would not only increase the quality of distribution data for the giant otter. As I already mentioned in my foreword to the standard survey method of the Eurasian Otter in Europe, I also hope that it will support the development of similar standardised survey methods for other otter species.

Hankensbüttel, December 2004

Claus Reuther
Chairman IUCN/SSC Otter Specialist Group

CLAUS REUTHER DEDICATION-PAGE

by
Jessica Groenendijk

Jessica GROENENDIJK

1. Introduction

Distribution and population data collected in a standardised format is a valuable tool for the protection and management of species and their habitats (REUTHER et al. 2000). Standardised survey methods are designed to provide reliable, comparable and user-friendly data, thereby increasing the time and cost efficiency of data gathering/processing.

The giant otter (*Pteronura brasiliensis*) is listed as endangered (EN A3ce) in the IUCN Red List (IUCN 2004). This means that a population size reduction of greater than or equal to 50% is suspected to be met within three generations (in the case of the giant otter this represents approximately 21 years). The word 'suspected' is indicative of the uncertainty we feel regarding extent of giant otter distribution and population sizes in most parts of the species' range. Although hunting for the pelt trade is no longer an issue, this has been replaced by a far more insidious threat: habitat degradation and destruction. Deforestation, gold mining, human colonisation along water courses, over-fishing, occasional hunting, poorly managed tourism, disturbances, and domestic animal diseases have all been identified as causal factors resulting in a reduction in habitat quality for giant otters (GROENENDIJK 1998, SCHENCK and STAIB 1998, SCHENCK 1999). However, in order to be able to assess more exactly how habitat destruction is impacting the species, now and in the future, we *urgently* need to know the current distribution and population status.

Giant otters are exceptionally well adapted to life in aquatic habitats in the tropical lowlands of South America and are found living in rivers, creeks, lakes, reservoirs, marshes, as well as flooded forest during the rainy season. Figures 1 - 13 illustrate the tremendous variety of giant otter habitats where studies/surveys are currently being carried out. It is the size of the giant otter's range and the diversity of its habitats (and the extreme isolation and inaccessibility of some of these) that will undoubtedly present obstacles when implementing and refining the proposed standard survey methodologies for the species. However, this should be seen as a challenge to be resolved rather than a reason not to proceed.

Since the first long-term giant otter study in Suriname between 1976 and 1978 (DUPLAIX 1980), distribution surveys and population censuses have been conducted in several countries of its former and present distribution range (SCHENCK 1999, GROENENDIJK et al. 2001, VAN DAMME et al. 2002, LASSO and ACOSTA 2003, DUPLAIX 2003) but not in a standardised manner and with widely differing interpretations of results.

Although experiences in Peru formed the starting point for this document, it is hoped that it reflects and addresses survey conditions and realities throughout the giant otter's range.

Establishing Guidelines for Standardisation

When establishing guidelines for a standard method for giant otter surveys, it is fundamental to keep in mind that:
- defining a standard is exactly what we are attempting to do,
- it should be possible for all future giant otter surveys to adhere to the established survey standards,
- simplicity and pragmatism are vital if the system is ever to be widely implemented, and
- the associated cost and effort is optimised in order to justify carrying out the surveys on as large a scale as necessary/possible.

A standard method should be equally applicable by experienced giant otter researchers and by volunteers with a minimum of survey training. The standardisation process attempts to minimise variation in collection, processing and interpretation of data, but it will be impossible to factor in variation in the surveyor's level of experience and performance.

Also, a survey standard will not address all possible field circumstances, habitat realities and surveyor requirements. We recognise that giant otters live in a wide variety of habitats to which they respond with a spectrum of behaviours. Therefore, what is described as 'usual' giant otter behaviour for the sake of establishing a standard, must not be understood to imply that it is the *only* possible behaviour that is witnessed in the field.

Furthermore, the purpose of this document is to give surveyors a *standard procedure* to follow when conducting a giant otter survey. It is not meant to address the more exacting demands of research projects. Researchers, of course, can add to these methods of data collection to suit their own needs but must not change these procedures when conducting a survey.

Finally, the necessity for practicality in the field will occasionally oblige us to define guidelines in flexible terms (for instance, see chapter 3 under Survey distance and bank).

Fig. 1: The Rio Negro, a blackwater river in the Pantanal, Brazil (Photo: N. Duplaix).

Fig. 2: The Manu River, a whitewater river in Manu National Park, Peru (Photo: F. Hajek).

Fig. 3: Cocha Salvador, an oxbow lake in Manu National Park, Peru (Photo: F. Hajek).

Fig. 4: The Palma Real River, a headwater of the Madre de Dios River, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 5: View of a Mauritia palm swamp, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 6: Inside a Mauritia palm swamp, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 7: Blackwater creek, Manu National Park, Peru (Photo: F. Hajek).

Distribution survey

The main objective of a distribution survey is to determine the spatial occurrence of the species within a given area, expressed in terms of presence or absence, focusing primarily on signs - dens, campsites and tracks - as clear indicators of giant otter presence.

Counting and identifying giant otter individuals are not a priority in a distribution survey. Sightings and numbers of individuals are recorded but not actively sought. Statements about giant otter abundance/density in an area should therefore be avoided after distribution surveys; it is probable that several individuals or groups have been missed or double-counted.

Fig. 8: The Lower Orinoco River, Orinoquia, Colombia (Photo: M. Velasco).

Fig. 9: Akuri oxbow lake, Rupununi, Guyana (Photo: N. Duplaix).

Fig. 10: Cocha Totora, an oxbow lake covered in aquatic vegetation Pistia sp., Manu National Park, Peru (Photo: F. Hajek).

Fig. 11: A whitewater river and associated oxbow lakes, Manu National Park, Peru (Photo: A. Bärtschi).

Fig. 12: Rapids on the Upper Coppename River, Surinam (Photo: N. Duplaix).

Fig. 13: Balbina Reservoir, Amazonas, Brazil (Photo: N. Duplaix).

By targeting campsites and dens, distribution surveys tend to emphasise presence/absence of resident groups (since transient individuals have rarely been seen to use campsites or dens). However, tracks can be of group members or transient individuals.

When a distribution survey reveals the presence of giant otters within a given area, a relative abundance survey or population census may be the next step. So far, survey intensity in different countries (i.e. time period, total area covered, number of persons involved, etc.) has been highly variable.

Population census

A population census aims at counting all giant otter individuals within a defined survey area in order to determine population size.
To carry out a true census the following criteria must be approached as closely as possible (JARMAN *et al.* 1996):

1. The entire survey area, not just sample plots within it, must be searched.
2. All animals in the survey area must be detected and counted, and none must be counted twice.
3. The census must be conducted over a short period so that no immigrations, emigrations, births, or deaths occur, and in a way that ensures no animal will evade the observer and leave the area before it is counted.

In the case of the giant otter, we are able to approximate these ideal criteria:

1. Most types of giant otter habitat can be accessed by boat (with the exception of some marsh habitats, rivers with many rapids or waterfalls, and very narrow creeks); therefore, entire survey areas can be covered.
2. The giant otter is a large, easily visible species that is exclusively diurnal and occupies open habitats, in groups that are not too large to be accurately counted. Each individual is identifiable by its unique throat marking making it possible to avoid double counting. If fresh sign indicates that giant otters are present, sites are re-visited during the census until the group is encountered. In areas of low human disturbance, the characteristic behaviour of giant otters to investigate intruders ensures that the surveyor is usually not avoided.
3. Giant otter censuses are carried out over a period of several weeks, at the end of the dry season, when the water level is low and otters are restricted to permanent water bodies (therefore movement out of the census area is minimised) and the year's litters are already born (therefore additional births are unlikely).

Relative abundance survey

Incomplete counts of individuals within the total or sample area, or complete counts within a sample area, using established sample count techniques, allow us to estimate absolute or relative population abundance.

Although relative abundance estimates are a necessary and powerful tool for species conservation, the giant otter research community is at an exploratory stage regarding the standardisation of relative abundance surveys. Therefore, guidelines for relative abundance surveys are not included in this document, but are addressed in some detail in chapter 5.

In order to optimise the use of (limited) resources, two or more of the described surveys may be carried out simultaneously during a field trip.

About this document

A brief description of the layout and content of this document follows:

Chapter 2 describes the Standard Field Survey Techniques for the Giant Otter (SFST-GO). The SFST-GO attempts to standardise such basic aspects as the correct identification and ageing of giant otter dens and campsites, as well as filming and counting individuals in the field.
Appendix 1 is added to help avoid confusion with Neotropical otter *(Lontra longicaudis)* signs and sightings while Appendix 2 summarises the points that have been highlighted in the main body of text and can be laminated for field use.
Appendix 3 recommends further literature for (new) surveyors.

Chapter 3 presents the Range-wide Distribution Survey Strategy for the Giant Otter (RDSS-GO) which includes the Standard Distribution Survey Method for the Giant Otter (SDSM-GO). In contrast to the SFST-GO which is relevant for all survey types, the Standard Distribution Survey Method addresses only distribution surveys. This is because, although many otter biologists and policy makers prefer to deal with otter numbers (arising from population size estimation methods or population censuses that rely on sightings of animals), this is only possible on a relatively small scale if the associated cost, manpower and time budget is not to become prohibitive.
Only distribution surveys, which are less resource-demanding since they can determine presence/absence of a species using sign as well as direct sightings, are feasible, repeatable, and necessary on a national or international scale.

The SDSM-GO establishes standard operational guidelines for the planning and execution of any distribution survey, whether at the local, regional, national or international level. A model of a data collection report for distribution surveys, and censuses, is provided in Appendix 4. This form also allows the possibility of recording accidental field data, or data arising from publications or questionnaires (Appendix 5 offers a giant otter questionnaire for use in the field). Appendix 6 gives extra background information regarding geographic issues.

The RDSS-GO focuses on the bigger picture, on determining and presenting distribution patterns in the long-term (from which - it can be argued - inferences may be made about giant otter population trends) by coordinating and implementing the SDSM-GO. At this level, the strategy must address such aspects as periodicity of surveys, prioritisation of areas, personnel aspects, data handling and management, presentation and interpretation of results, and funding. Preliminary notes on selecting/capacitating new surveyors are outlined in Appendix 7.

Chapter 4 provides Population Census Methodology Guidelines for the Giant Otter. Due to time and cost constraints, a population census is unlikely to be carried out on a regional scale, let alone a national or range-wide level. It is more probable that a population census is conducted as part of a study into, for example, demographics, within a protected area or in an area of particular conservation concern. Nonetheless, population census field methodology and data recording may be usefully standardized to a certain degree.

Chapter 5 offers Suggestions and Ideas for Further Research which may help to improve the guidelines for standardisation of giant otter survey methodologies.

Appendix 8 lists addresses and other contact

Jessica GROENENDIJK, Nicole DUPLAIX, Frank HAJEK,
Christof SCHENCK, Elke STAIB

2. Standard Field Survey Techniques for the Giant Otter (SFST-GO)

The aim of this chapter is to act as a comprehensive guide for the identification and ageing of giant otter sign, and the observation, counting and recording of giant otter groups and individuals. Errors are commonly made during these procedures so we have gone into considerable detail. However, Appendix 3 outlines the most important aspects for quick field reference.

We begin by describing characteristic signs of giant otter presence, then go on to mention two additional signs, cylindrical scats and scratch walls, which are less widely recognised or are not seen throughout the species' range. Next, we indicate how to identify and age giant otter campsites and dens, and explain the methodology for observing, counting and recording individuals. Finally, we emphasise the importance of minimising negative impacts of surveys on giant otters, and provide a list of essential survey equipment.

2.1 Characteristic Signs of Giant Otter Presence – Campsites, Dens and Tracks

When conducting a survey, reliably identifying signs of giant otter activity is sometimes the only means by which presence of the species can be confirmed. Familiarity with existing giant otter literature, especially descriptions (including photographs and measurements) of campsites, dens, and tracks is therefore necessary (see Appendix 4 for a list of recommended literature).

Campsites

Campsites are irregularly-shaped patches of land on the banks of water bodies, which have been cleared of vegetation (if present) and which are used for defecating, scent marking, drying out, grooming and resting (DUPLAIX 1980, LAIDLER 1984, SCHENCK 1999, STAIB 2002). Sizes vary: between 0.64m² and 45.05m² in south-eastern Peru with the average being 5.08m² (STAIB 2002); in Guyana average campsite size was 30m² (LAIDLER 1984); and in Surinam average size in three different locations was 55.30m², 85.26m² and 54m² respectively (DUPLAIX 1980).

They are often positioned well above water level and directly next to the water body, beneath overhanging vegetation, and in a prominent, highly visible location such a river confluence, a beach, or at a sharp river bend. They are also often associated with cross-over points (locations where giant otters habitually take short cuts over land) between a river and a nearby lake, or across a river bend (see Figures 14 - 25). Well-worn paths may lead from the campsite to a nearby water body.

A campsite may be used once only and then never again, or for many years (even decades) by different groups (STAIB 2002, DUPLAIX 2003). A fresh campsite in a specific area is usually being used by a group known to occupy the area. However, one can never say for certain that tracks on the campsite were left by that group; a transient may have stopped to investigate, for instance, or there may be an invasion of the territory in progress by another group. Eventually, another group may use the same campsite.

Over the course of years, some campsites may expand and incorporate others nearby, especially in areas where there are few suitable locations on a river bank. Only portions of these extended sites may be used at any one time. Latrine and den locations within the campsites may change and dens collapse. Site attraction appears to be based on strategic location and may dictate long-term use of particular campsites (DUPLAIX 1980, Staib 2002).

It is important to emphasise that a 'campsite' represents a site where a variety of giant otter land activities take place, and includes at least one latrine area. Sometimes a campsite will consist of a latrine only. However, a latrine that is next to a den entrance is not recorded as a campsite.

Latrines

Within each campsite there are one or more latrine areas of varying freshness, often on the periphery of the site, characterised by the presence of scales and other hard fish remains such as vertebrae, otoliths, teeth and large spines (for this reason, people sometimes say campsites are places where giant otters eat their prey). There are also often latrines directly below or in front of a den's entrance. Defecation and urination on the latrine may be - but is not always - followed by thorough trampling and mixing of the scats (DUPLAIX 1980, SCHENCK 1999, STAIB 2002).

Fig. 14: Campsite on a river bend, Xixuau Reserve, Amazonas, Brazil (Photo: E. Evangelista).

Fig. 15: Campsite behind floating vegetation, Kaburi Creek, Surinam (Photo: N. Duplaix).

Fig. 16: Campsite with a recently used latrine, Balbina Reservoir, Amazonas, Brazil (Photo: N. Duplaix).

Fig. 17: Campsite hidden behind 'mokomoko' (Montricardia arborescens)*, Kaburi Creek, Surinam (Photo: N. Duplaix).*

Fig. 18: Campsite on a dry season beach, Palma Real River, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 19: Campsite at the mouth of a small tributary, Palma Real River, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 20: Campsite on a boulder, Coppename River, Surinam (Photo: N. Duplaix).

Fig. 21: Campsite with fresh untrampled scat, Palma Real River, Peru (Photo: F. Hajek).

Fig. 22: Otters resting on a sandy bank campsite, Balbina Reservoir, Amazonas, Brazil (Photo: N. Duplaix).

Fig. 23: Campsite on a floating vegetation mat, Nanni lake, Surinam (Photo: N. Duplaix).

Fig. 24: Campsite obscured from view by river bank vegetation, Manu National Park, Peru (Photo: C. Schenck).

Fig. 25: Campsite on a small island, Patuyacu River, Tambopata National Reserve Peru (Photo: F. Hajek).

Giant otter scats are loose, dark-greenish deposits of faeces, comprising predominantly fish scales and other hard parts, as well as thick mucous. However, scat appearance may vary according to diet composition. In campsites, scats are usually actively mixed with those of other group members, but occasionally untouched scats remain on the latrine(s). These darken with the drying action of the sun and air, so that several hours after having been deposited they appear black and glutinous. If prised apart, the interior will still be greenish in colour. Transient giant otters do not establish their own campsites, but may visit those of groups, sometimes leaving a scat that is not trampled (note, however, that an untrampled scat does not necessarily indicate that a transient has visited the campsite).

Evolution of the physical appearance of a campsite

When very fresh, the campsite's odour is powerful and fishy and may carry far. Large numbers of insects (sweat and honey bees, ants, butterflies and flies) arrive within hours of the otters leaving the latrine area(s). The substrate is damp or muddy, and nearby vegetation (twigs and saplings) is damaged but still green (appearing bedraggled, stripped, chewed and/or muddy since otters also mark by dragging leafy branches under their bellies and pulling them down with their forearms). Leaf litter is minimal and tracks or semicircular 'sweep marks' may be evident (substrate permitting). Pools of urine may be present, again, depending on the substrate. Some dark clumps of fish hard parts may be found but more often faeces have been mixed thoroughly with earth; scales are intact, flexible when handled, and transparent.

As the days pass (and the campsite is not re-visited), insect activity gradually decreases and the bees, ants and butterflies may be replaced by termites. Odour also becomes less pronounced (but can still be detected close to the latrine area), and the substrate begins to dry. Trampled leaves start to droop. Tracks may no longer reach to the water's edge or may become flooded with changes in water level (this is particularly true for river habitats; hence special note must be taken of changes in water level over time since these may be useful indicators of the exact day when the site was last visited by otters).

With increasing age, fish scales become separated and are dispersed by insect and bird activity and rain, the odour becomes mustier and leaf litter starts to accumulate. Trampled twigs and leaves desiccate. As the weeks pass, scales become brittle and are broken down more readily, lose their transparency and become opaque or yellowish in colour.

It is very important to note that the evolution of the appearance of a given campsite is:
- highly weather related,
- dependent on location (e.g. a campsite under dense, overhanging vegetation appears fresher for longer than one fully exposed on a beach), and
- dependent on whether the otters have used the site repeatedly (visits may be spaced several days apart, or the site may be visited daily for a period of time).

In very hot, dry weather, scats on an exposed campsite will dry out and crumble quickly. A heavy, prolonged downpour on a recently used campsite will give it a deceptively old appearance, erasing odours almost entirely, discouraging insects, washing off many scales and blurring tracks. Likewise, after a light rain a campsite that has not been recently used may appear fresher than it is, having been 're-activated' so that it is again attractive to insects such as bees and butterflies. This is one of the reasons why surveys should not be conducted during the wet season, and rain during the dry season is an important factor that must be taken into account when estimating the age of tracks, dens and campsites. Within a single territory there may be many campsites and dens but only a small number are actually in use at any one time. Furthermore, so far campsite/den size and group size have been found to be unrelated (STAIB 2002).

Dens

A den consists of one or more tunnels leading to one or more oval chambers excavated into the bank of a water body. In Surinam, tunnel entrances with a width of between 40 and 60cm and a height of between 30 and 40cm were reported; tunnels measured 30cm to 3.6m in length; and chambers measured 1.2m to 1.8m in diameter and 43cm to 74cm in height (DUPLAIX 1980). In Peru, measurements of a single den were similar (STAIB 2002). Small air holes may also be present, and sometimes submerged entrances are found (DUPLAIX 1980). Dens are communal, used for sleeping and cub rearing, and are frequently located under root systems or fallen trees (see Figures 26 - 38). A recently used den is indicated by:
- moist, trampled vegetation,
- a muddy slide' or concave path (through repeated use), and/or numerous tracks that lead from the entrance directly to the water's edge, and
- usually at least one latrine which is often located either directly in front of or to one side of the den entrance, or in the immediate vicinity. In addition to this latrine, there may be a separate campsite (with its own latrine(s)) nearby. Not all dens, however, have a latrine at the entrance. In dense reeds or in swampy habitats (such as the Pantanal (MARMONTEL pers. comm.) and swamps in the Guianas), the latrine may be many metres away on the same or opposite bank. In this case, the latrine would be recorded as a campsite.

Spider webs, accumulation of leaf litter and/or termite trails in or near the entrance help to indicate a den that has not been used recently.

In the Brazilian Pantanal and reed marshes in Surinam, giant otters often sleep in the midst of vegetation, in beds or 'dorms' that are sculpted by their bodies. These

Fig. 26: Den with a typical cleared slide down to water level, Parana River, Xixuau Reserve, Amazonas, Brazil (Photo: E. Evangelista).

Fig. 27: Den high above water level, Balbina, Amazonas, Brazil (Photo: E. Evangelista).

Fig. 28: Otters leaving their den at dawn, Cocha Salvador, Manu National Park, Peru (Photo: F. Hajek).

Fig. 29: Giant otters also spread scat on latrines in front of their dens, Manu National Park, Peru (Photo: F. Hajek).

Fig. 30: Den under a granite ledge, Orinoco River, Colombia (Photo: J. Botello).

Fig. 31: Den, Manu National Park, Peru (Photo: F. Hajek).

Fig. 32: Den with recently excavated earth at entrance, Xixuau Reserve, Brazil (Photo: E. Evangelista).

Fig. 33: Otter emerging from a den after midday rest, Manu National Park, Peru (Photo: F. Hajek).

Fig. 34: Den in the roots of a fallen tree, Manu National Park, Peru (Photo: F. Hajek).

Fig. 35: Den at the base of a tree, Parana River, Xixuau Reserve, Amazonas, Brazil (Photo: E. Evangelista).

Fig. 36: Den with a double entrance, Balbina Reservoir, Amazonas, Brazil (Photo: Projeto Ariranha).

Fig. 37: Den, Rio Negro, Pantanal, Brazil (Photo: N. Duplaix).

Fig. 38: Shallow den used by a transient. Note the untrampled scat in the leaf litter at the entrance, Manu National Park, Peru (Photo: F. Hajek).

Fig. 39: Tracks in mud with webbing visible, Manu National Park, Peru (Photo: F. Hajek).

Fig. 40: Tracks in mud, claws visible, Yasuni National Park, Ecuador (Photo: V. Ureras).

Fig. 41: Tracks in sand with webbing and claws visible, Manu National Park, Peru (Photo: F. Hajek).

Fig. 42: Tracks in sand among rocks, Orinoco River, Colombia (Photo: M. Velasco).

are usually very difficult to find as they are located under abundant overhanging vegetation. Some families only use dorms and spend several consecutive days or weeks in the same site (MARMONTEL pers. comm., DUPLAIX 1980).

Transients are very discrete and there is very little information available about their use of dens (STAIB 2002). They sometimes excavate shallow dens for resting, perhaps by expanding slightly on natural hollows, cracks or holes in banks. It is also possible that they seek shelter in the hollow bases of tree trunks or in dense vegetation.

Tracks

The most distinctive features of giant otter tracks are their size and their elongated toes, rather like the prints made by the tips of human fingers (see Figures 39 to 46). Measurements taken in Manu National Park (Peru), the Rio Negro (Brazilian Pantanal), and in Dortmund Zoo (Germany) show that the hind foot averages 10.5cm in width by 13cm in length (n=23) while the forefoot measures an average of 9.5cm in width and 10.4cm in length (n=32) (REUTHER unpubl. data). Occasionally, well used paths several hundred metres in length are found between two different water bodies.

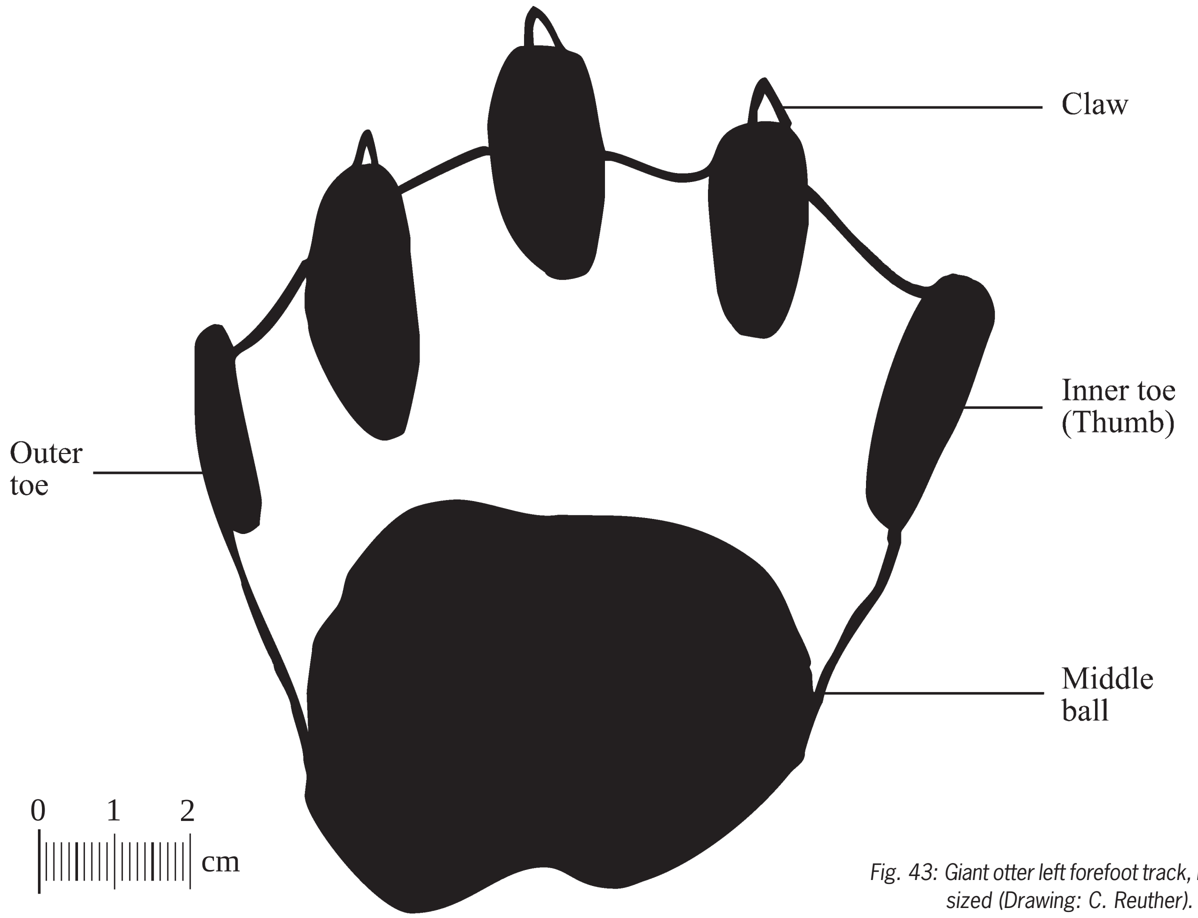


Fig. 43: Giant otter left forefoot track, life-sized (Drawing: C. Reuther).

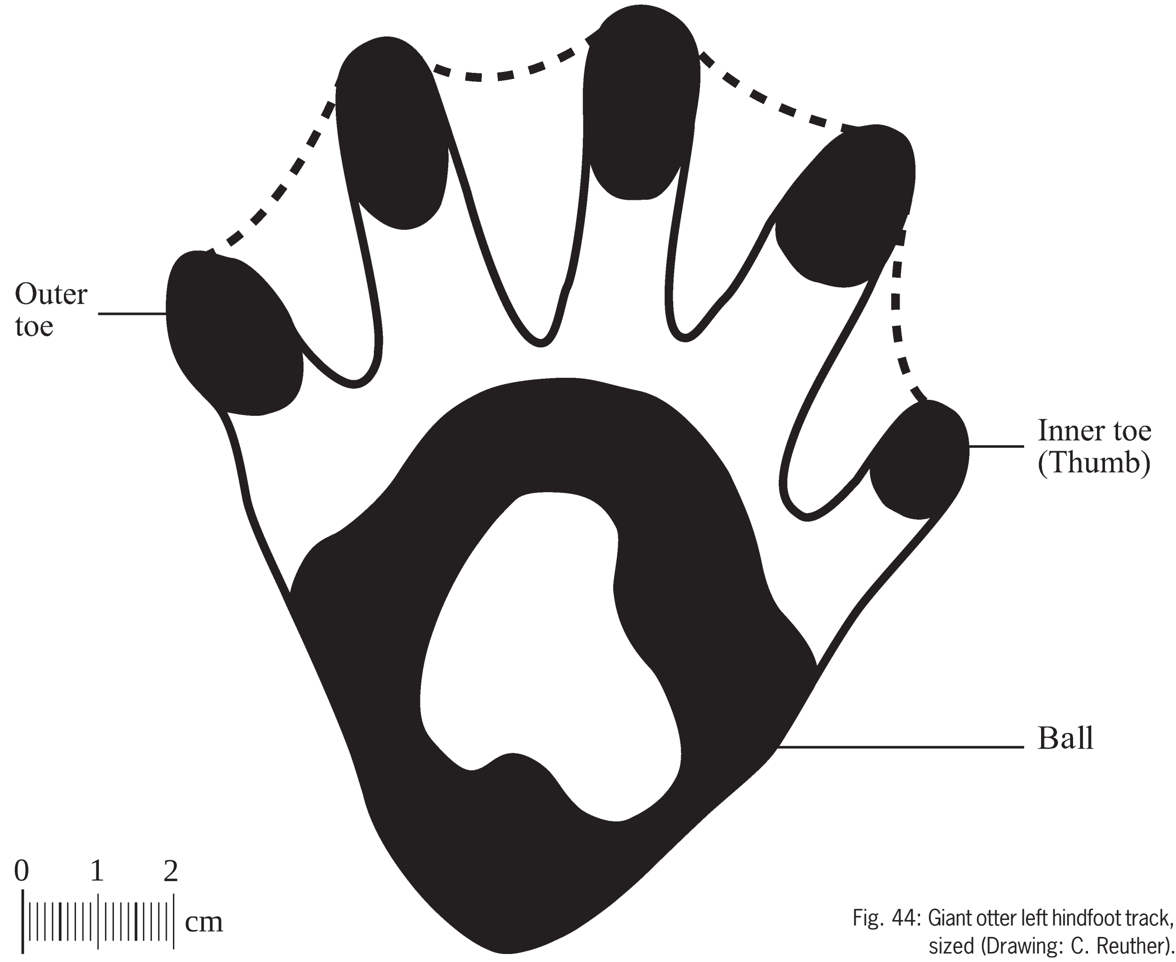


Fig. 44: Giant otter left hindfoot track, life-sized (Drawing: C. Reuther).

Giant otters will sometimes investigate Neotropical otter (*Lontra longicaudis*) dens (and vice versa), leaving tracks on the shoreline; the tracks of the inhabitant will be found at the den entrance (see Appendix 2 for a comparison of giant otter and Neotropical otter sign measurements).

Tracks are not only associated with dens and campsites; giant otters often walk over shallow beaches or river banks, and their tracks *may* provide a useful hint of the direction they were travelling in. However, <u>sets of tracks are not a reliable indication of the number of otters in a group</u>; one or more individuals may have opted to continue by water rather than by land. On the other hand, absence of tracks does not necessarily mean absence of the species. Tracks in mud may last and appear fresh for a surprisingly long time whereas those in sand become blurred relatively rapidly. Other substrates, such as compacted earth or rock, will not show tracks (clearly); in these habitats, tracks are therefore not a useful sign of giant otter presence.

2.2 Additional Signs of Giant Otter Presence – Cylindrical scats and Scratch walls

The following are additional signs of giant otter presence that are not mentioned in subsequent chapters since they can be said to be less characteristic of the species or not encountered in all regions of the giant otter's range and therefore inappropriate to include in standardised survey methodologies.

Cylindrical scats

In most regions of the giant otter's range, giant otter scats do not have a defined shape, are usually trampled on campsite latrines, and are not deposited singly. However, in the Guianas it is not unusual to find an intact, (semi-) cylindrical scat that has been deposited in a location (e.g. on logs or smaller rocks, or in hollows and outcroppings), often near rapids, that does not form part of a campsite (see Figures 47 and 48) (DUPLAIX 1980, 2003). It is thought that this is either because there is very little room at the site for the otters to manoeuvre or because the vegetation/substrate does not allow the creation of campsites. Cylindrical scats (often referred to as single scats), ranging in length between 14 to 21cm, are generally larger than Neotropical otter scats. However, lengths are variable and there is some overlap in size of scats containing crab remains. One of the most important differences between giant otter and Neotropical otter cylindrical scats is in diameter. Giant otter cylindrical scats are 2.8 to 3.5cm in width versus a width of 0.8 to 2.5cm for the Neotropical otter. Scats with crab remains are generally larger than scats with fish. Note that, on larger, flatter rocks or boulders, giant otters will also trample and spread the scat as they do on a campsite latrine.

DUPLAIX hypothesises that giant otters deposit cylindrical scats seasonally and only in certain types of habitats, namely rocky, flat granite plateaus where rivers in the dry season are studded by numerous islands, sand bars and outcroppings. In the wet season, these cylindrical scat sites are submerged and the otters resort to campsites (some of which are the same as during the dry season) that tend to be spaced further apart. Single scats are also sometimes deposited on large roots at the base of a tree on a vertical bank where there is no room for a latrine. PINOS (pers. comm.) has also reported giant otters depositing scats on the root bases of Mauritia palm trees (*Mauritia sp.*) in swamps in Ecuador, because terra firme was not available to clear campsites.

Scratch walls

A 'scratch wall' is a vertical, often clayey patch of bank, usually near a den or campsite, which is covered in long, deep scratch marks (see Figures 49 and 50). These may be visible for many weeks or months after the den or campsite was last used and may therefore be a deliberate visual signpost. Scratch walls should not be confused with general entry/exit points to sites, where deep scratches may also be present. Instead, otters seem to go out of their way to create scratch walls, sometimes parallel to the access route to the den/campsite. Their function and occurrence needs to be documented further. In big cats (tigers, cheetahs etc.) scratch marks on trees play an important role in territory demarcation. With more data, it may prove valuable to include scratch walls as a characteristic giant otter sign. Note that Neotropical otters also make scratch walls.

2.3 Identifying a Giant Otter Campsite or Den

Giant otter campsites and dens are often misidentified. There are many other animals that eat fish, including the Neotropical otter, various cat species, and birds such as kingfishers, herons, and cormorants, any of which may leave fish remains along the shore. Even humans may have a favourite fishing spot where they will gradually wear away vegetation and clean fish (although such fishing sites will usually exhibit other signs of human presence). Other fish-eating animals do not usually leave numerous dispersed scales, so a large

Fig. 43: Tracks down to water level at a recently used campsite, Xixuau Reserve, Amazonas, Brazil (Photo: E. Evangelista).

Fig. 44: Size comparison of a forefoot track, Manu National Park, Peru (Photo: C. Schenck).

Fig. 47: Untrampled cylindrical scat on sand, Coppename River, Surinam (Photo: N. Duplaix).

Fig. 48: Untrampled cylindrical scat, Coppename River, Surinam (Photo: N. Duplaix).

accumulation of scales could theoretically be used as a specific indication of giant otter presence. However, on testing this assumption during the Peru field courses/workshops, it was found that a reliable criterion (e.g. the requirement of a minimum number of scales) could not be established. Similarly, Neotropical otters have dens that are very similar to a giant otter's (see Appendix 1), as do armadillos (Dasypodidae) and agoutis (Dasyproctidae). In fact, agoutis, Neotropical otters, and other animals sometimes take-over abandoned giant otter dens and may therefore give the wrong impression that the den is still in use by giant otters.

<u>Correctly identifying a giant otter den or campsite is all that is required in a distribution survey; estimating whether it was used recently or not is unnecessary.</u> During the field courses/workshops in Peru, a number of potential characteristics of giant otter sign were identified and tested for use in identification. These included odour, and presence of insects, trampled vegetation, a cleared area, fish hard parts, and tracks. The characteristics that were found to be most useful in indicating a giant otter den or campsite are:

- a cleared space or hole in the bank,
- fish hard parts that have been dispersed over the latrine area, and
- tracks leading up to, or in, the site.

Fig. 49: Scratch wall on a clay bank, Balbina Reservoir, Amazonas, Brazil Photo: N. Duplaix).

Fig. 50: Scratch wall at mouth of small creek, Palma Real River, Peru (Photo: F. Hajek).

However, in some habitats a surveyor will not encounter clearings or tracks. For instance, in rocky environments (e.g. the Orinoco River in Colombia), giant otters may establish some campsites on boulders, although they will also seek out available sandy patches (Botello pers. comm.). For the sake of simplicity and clarity, these should be considered exceptions to the rule and no allowances should be made for them when standardising; it is anticipated that even here giant otters will locate sites where clearings can and are made, and surveyors will eventually find these at some point within the survey area.

<u>A cleared space is recorded as a campsite only if a layer of *dispersed* fish hard parts is present in the latrine area(s)</u> (see Key to Identifying and Ageing Giant Otter Campsites, this chapter). Finding a cleared space only is <u>not</u> sufficient. Fish hard parts do not necessarily have to include scales (on some campsites in the Pantanal, for instance, bones and other hard parts, but no scales, were found (WALDEMARIN pers. comm.), presumably due to a higher proportion of siluriformes in the otter diet (ROSAS et al. 1999). If fish hard parts are entirely absent then either the campsite is so old that it should not be included in the survey because the otters may no longer be around, or the clearing has nothing to do with giant otter activity (capybaras and tapirs often wear down patches on banks). If fish hard parts are found but they are not dispersed over the latrine area (by the actions of the otters themselves), then the clearing does not qualify as a giant otter campsite.

<u>A hole in the bank is only a giant otter den if dispersed fish hard parts, and/or tracks leading up to, or in, the entrance, are present</u> (see Key to Identifying and Ageing Giant Otter Dens, this Chapter). Situations will arise where the surveyor is convinced the den or clearing qualifies as giant otter sign and is tempted to record it even though it does not exactly meet the above criteria. This should be avoided; it is not necessary to locate every single giant otter sign (in fact, in a 'stop at first sign' survey, one is enough; see chapter 3 under 'Stop-at-first-sign' versus 'Full distance' surveys). But it *is* necessary to allow as little room for error and ambiguity as possible, particularly by less experienced surveyors, hence the 'strict' criteria.

2.4 Ageing a Giant Otter Campsite or Den

<u>During a population census, dens and campsites are recorded as being either 'not recently in use' or 'recently in use'</u> (this is unnecessary during a distribution survey), in order to determine zones of recent activity where more time needs to be spent in order to locate the otters. The terms 'not recently in use' and 'recently in use' are relative and reflect a balance of estimates. The word 'recently' may have different meanings for different surveyors; therefore, here 'recently' is broadly defined as meaning up to an estimated <u>two weeks</u> prior to the surveyor's visit.

The three primary factors (in order of priority) for determining whether a site is 'recently in use' are:
- presence of dispersed fish hard parts,
- appearance of vegetation trampled by giant otters during marking, and
- clarity of tracks; all are influenced by recent and current weather conditions.

Other possible factors for ageing campsites/dens, such as odour intensity, insect numbers and species, and thickness of leaf litter, were found to be too highly variable or prone to errors in judgment and therefore unreliable, although they may serve as secondary criteria to confirm a decision based on the primary criteria (see Table 1 and Figures 51 to 57).

<u>A campsite is only recorded as 'recently in use' if: (1) dispersed fish hard parts are present, (2) together with moist trampled vegetation and/or clear giant otter tracks leading up to, or in, the site</u> (see Key to Identifying and Ageing Giant Otter Campsites, this chapter). The word 'moist' is used to describe plant material that may have begun to wilt but is still green and not dried out (i.e. not moist from contact with a wet otter or rain). Obviously, when there is new plant growth (seedlings, trampled saplings that are sprouting new leaves) then this is a clear indication that the site has not been recently used.

<u>A den is only recorded as 'recently in use' if: (1) dispersed fish hard parts are present together with either moist trampled vegetation and/or clear tracks leading up to, or in, the entrance, (2) fish hard parts are absent, but moist trampled vegetation and clear tracks leading up to, or in, the site are present</u> (see Key to Identifying and Ageing Giant Otter Dens, this chapter).

Fig. 51: Giant otters trampling vegetation on a campsite, Manu National Park, Peru (Photo: F. Hajek).

Fig. 52: Den not recently used as evidenced by new plant growth and accumulation of leaf litter, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 53: Recent, green, untrampled scat with insects on a campsite, Palma Real River, Peru (Photo: F. Hajek).

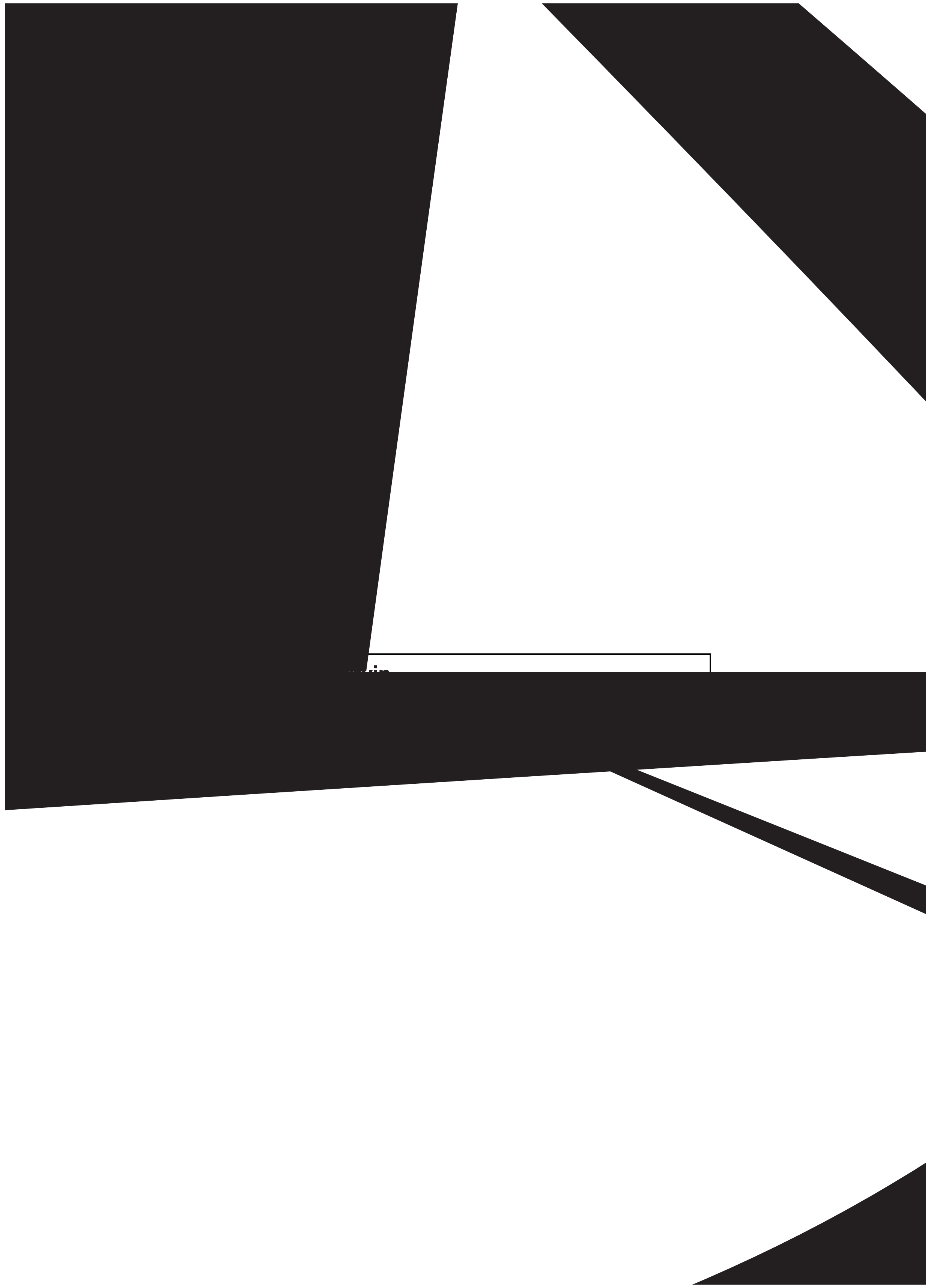
Fig. 54: Recently trampled vegetation on a campsite, Coppename River, Surinam (Photo: N. Duplaix).

Fig. 55: Trampled vegetation on a campsite, Patuyacu River, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 56: Den in use with tracks right down to the water level, Xixuau Reserve, Amazonas, Brazil (Photo: E. Evangelista).

Fig. 57: Undeteriorated, transparent fish hard parts found on a recently used campsite (Photo: C. Schenck).

<u>Correctly identifying a campsite or den as 'recently in use' rather than 'not recently in use' is significant during a population census since it justifies remaining in the area in order to make a concerted effort to find the group</u>. When only old signs are encountered, then the lake/stretch of river is re-visited several days or weeks later in the hope of finding fresher evidence. When recent evidence is found, but the group is absent, it is advised to re-enter the area in the afternoon, or early morning the following day. Time should be allowed with-



in the travel schedule for a number of such re-visits. We recommend that first-time researchers and surveyors should begin by charting the appearance of a den and campsite over time, to identify the above criteria in their own survey environment.

When a campsite or den is defined as 'not recently in use' it means that it has not been visited by giant otters for some time. It does not necessarily mean that the site has been abandoned (i.e. that the group has no intention of ever returning). Giant otters may move to a new den and come back to the old one the next day; they may also stop using a campsite for a couple of weeks or even months and then re-visit it. This is why the expression 'abandoned' should be avoided. Terms such as 'fresh' and 'old' are also inappropriate since these give rise to the tendency to categorise – 'very fresh', 'quite fresh', 'very old' – statements which have different meanings to different people. 'Recently in use' and 'not recently in use' are also subjective phrases, but are more comprehensive and less open to different interpretations.

If a den or campsite is found to be 'not recently in use' at one point during the population census, but later is re-visited by the surveyor and discovered to be 'recently in use', then when reporting on the census results the final status of that sign is 'recently in use' (for this reason, non-recent sign should still be recorded during a population census, as an indicator of potential giant otter presence in the area later during the census time period). On the other hand, if a den/campsite is 'recently in use' at the beginning of the population census, and later found not to have been re-used, it is still recorded as 'recently in use' in the census results. In summary, old sign may become recent during a census, and recent sign indicates giant otter presence, justifying further effort by the surveyor in the area to locate the individuals.

Sometimes, a den, a latrine at its entrance, and a campsite with one or more latrines may all be found in the same location. In this case, both the den and the campsite are recorded, but not the latrine since the latter is not considered a separate sign but is part of the den.

In borderline cases, when there is doubt as to whether a den or campsite should be labelled 'recently in use' or 'not recently in use', then it is recorded as 'not recently in use'.

No studies to date have shown a correlation between the distribution and number of dens and campsites and the number of giant otter groups in the area or number of individuals within a group (i.e. giant otter abundance/density cannot be deduced from signs of giant otter presence).

2.5 Recording Tracks

Tracks are only recorded if found not associated with dens and campsites, or if found on dens and campsites where the latrines have not been recently used (*possibly* indicating a visit by a transient).

2.6 Guidelines for Observing, Counting and Recording Giant Otters

Throat markings

Giant otters have irregular, pale throat patterns, each of which is unique, like a person's fingerprint (DUPLAIX 1980). These throat markings greatly facilitate identification of individuals from birth (see Figures 58 and 59). Occasionally, dark animals are seen (almost) completely lacking a throat marking; recognition is then only feasible – though much more difficult - using other permanent facial or bodily features, such as scars, missing teeth, etc. During field observations, when otters are most often seen in the water, it is the giant otter's characteristic throat marking as well as its larger size, domed skull, and rounded ears that distinguishes it from the Neotropical otter; the latter has a more flattened forehead, pointed ears, and lacks a marked throat pattern (see Figures 62 and 63) However, it is very easy to confuse the two species during brief glimpses in the field; local people do so frequently. When there is any doubt as to otter species, a giant otter sighting should not be recorded (see Figures 62 and 63). Ageing and sexing individuals (see chapter 4) are not a priority during distribution surveys.

Surveying in a paddled boat

At least two people are necessary to efficiently and simultaneously count and film a group of giant otters. It is when the animals periscope or rest on land that throat markings are obtained most easily (see Figures 64 to 67). Ideally, with the aid of binoculars to scan the river ahead or the shoreline, the otters are seen before they see the surveyor. There are then five options:

1. To approach the group, very slowly and discreetly, so that the surveyor remains unobserved;
2. To approach without the surveyor attempting to conceal him/herself;
3. For the surveyor to hide amongst vegetation by the shore and wait for the otters to approach;
4. To directly head towards the group and actively 'force' a periscoping situation; or
5. To follow the group at a distance, while it is aware of the surveyor's presence.

Fig. 58: Giant otter periscoping at the surveyor, Cocha Otorongo, Manu National Park, Peru (Photo: C. Schenck).

Fig. 59: Giant otter periscoping at the surveyor, Balbina Reservoir, Amazonas, Brazil (Photo: N. Duplaix).

Fig. 60: Close-up of a giant otter, showing rounded ears and domed forehead (Photo: N. Duplaix).

Fig. 61: Close-up of a Neotropical otter, showing triangular ears and flattened forehead (Photo: N. Duplaix).

Fig. 62: Side view of a Neotropical otter (Photo: N. Duplaix).

Fig. 63: Neotropical otter about to submerge. During brief sightings, without periscoping, the two species are difficult to differentiate (Photo: C. Reuther).

Fig. 64: Otter groups will usually approach the surveyor, especially in areas where they are not persecuted (Photo: N. Duplaix).

Fig. 65: Giant otters resting on logs provide an excellent opportunity for counting and filming. Cocha Cashu, Manu National Park, Peru (Photo: F. Hajek).

Fig. 66: Grooming activities also offer opportunities for filming throat markings, Karanambu, Guyana (Photo: N. Duplaix).

Fig. 67: Giant otters resting on land (Photo: N. Duplaix).

1. To approach the group, very slowly and discreetly, so that the surveyor remains unobserved is advised when the otter group is by the shore, resting on logs, or occupied on a campsite. It is preferable to observe a giant otter group quietly from a distance, and to wait patiently for opportunities to film throat markings since this approach causes the minimum amount of disturbance to the otters. However, it may take longer to film the throat patterns of all group members by this method.

2. Approach without the surveyor attempting to conceal him/herself as the boat is paddled cautiously towards them. The otters will likely become aware of the surveyor's presence while the boat is still some distance away. One or more individuals may then begin to swim rapidly towards the boat. The idea is then to stop paddling and keep completely still. Once the first individual periscopes – a term that accurately describes the distinctive behaviour of craning neck and head straight out of the water thereby sometimes displaying their entire forequarters – and snorts, the others will do likewise. To encourage the otters to feel that they are intimidating, the surveyor should begin to paddle backwards. This may intrigue the group and they will follow, thereby increasing the time available for filming the neck markings. The boat is paddled backwards until they lose interest. If, after immediate viewing of the footage, the surveyor finds that the number of throat patterns obtained does not equal the number of individuals observed, then the group can be approached again a little while later. The risk with this strategy is that, since the surveyor is approaching the group in the open, it may notice the boat while it is still too far to film adequately and, if it is a nervous group, may move away rather than come to investigate.

3. To hide the boat amongst vegetation by the shore and wait for the otters to approach is best if it is possible to roughly predict the direction and speed the group is travelling, allowing the surveyor to catch up and position him/herself in advance. Depending on the direction of the wind, it is possible that the group will approach sufficiently close for filming. The boat should be near vegetation in order to break its outline and hopefully arouse their curiosity, yet should not be so hidden that they approach to within three or four metres before they become aware of its presence. Otters can be very intent on what they are doing and literally often bump into danger before they are aware of it. The shock is then all the greater, and may reduce the time that the group spends periscoping. In such a situation, the surveyor should make a small noise or movement so that the group notices before it is too close (say, at 10 metres distance). Paddles should be handled carefully; sudden gestures will frighten otters so that, instead of periscoping, they submerge abruptly and reappear at a greater distance. It is important also to note that a large boat moving at speed often greatly alarms otters, especially if people stand up in the boat.

4. To directly head towards the group and actively 'force' a periscoping situation is justified only if it is anticipated beforehand that the group will be nervous, or if it has already reacted strongly; in other words, if there is one opportunity and the success rate has to be maximised. The idea is to approach unobserved along the shore to within a distance of about 50m and then to head directly for the group at a strategic angle, as gently as possible but nonetheless at some speed (otherwise the element of surprise is lost and the otters periscope too soon). It is important that at the moment of the surveyor's approach all the members of the group are clumped tightly together and that they are distracted by their activities, otherwise one or two individuals who happen to be nearer may spot the boat first, periscope, and then alert the others who may not periscope at all before the whole group retreats. Once the surveyor is satisfied that as many throat markings as possible from a single periscoping session have been filmed by this means, the boat should be paddled away immediately in the hope of reassuring the group that no harm was intended. The surveyor should not attempt the process again with a nervous group, since the otters may leave the area entirely for some time.

5. To follow the group at a distance that they feel comfortable with is an option in areas where otters are tolerant of people. Longer observation periods can be achieved and throat markings may be obtained during 'natural' (non–periscoping) activities, for example, sunbathing, grooming and feeding near the shore.

If the sighting occurs in the afternoon, it may be possible to follow the group in order to try to locate the den it is using. If the surveyor manages to remain unobserved and is able to watch the group entering the den, then he/she can return the next day, early in the morning, before the group is expected to leave the den, in order to record throat markings of the animals as they first emerge. The risk with this strategy is that the group may become aware of the surveyor's presence, and subsequently abandon the den. This should be avoided, especially if the census is carried out at the beginning of the breeding season. If the river is sufficiently narrow, the den can be observed from the opposite bank; the boat should be hidden several metres up- or downriver (e.g. by hauling it up the bank and out of sight if it is an inflatable), and the surveyor should walk along the shore until he/she can easily see the den entrance while remaining hidden.

Surveying in a motor-powered boat

On faster flowing rivers, travelling by motor creates a serious noise disadvantage; otters are either aware of the surveyor's presence well in advance and therefore have plenty of opportunity to quietly slip away, or, as when negotiating a narrow, meandering river, the otters are only able to pinpoint the source of the disturbance at the last moment, which is usually also when they are first sighted. This sudden confrontation may take both parties by surprise, and the otters may react by 'lying low' (hiding amongst shore-line vegetation and remaining motionless while holding their heads just above water level). Occasionally, however, an imminent sighting is indicated by increasingly fresh signs of giant otter presence or by waves and ripples on the water surface ahead. The surveyor is then able to take steps to minimise impact by:
- reducing speed,
- travelling along the middle of the river so that when a group or individual is observed, the boat can be directed towards the opposite bank to maintain distance, and
- avoiding shouts and sudden movements by using a signalling system.

The camera is prepared so that filming is possible immediately on sighting otters. In slower-flowing rivers (where the boat is not swept downriver), it is probably best to instantly switch the motor off, provided that communication is possible by whispering; human voices are sometimes alarming to giant otters so keeping the engine running but at its slowest speed may be another option.

PALMER (pers. comm.) developed a system for passively approaching otters while travelling downriver, involving the use of two anchors to control drift speed and observation location. When a group is spotted, the engine is switched off and the first anchor is dropped overboard to control drift speed until the desired observation location is reached. The second anchor is then dropped to maintain the position. This system allows the surveyor to drift with the group and to adjust the observation position when necessary.

The width of the river tends to influence giant otter reaction, as well as that of the surveyor. In narrow rivers or creeks (say, less than 30m), otters often either maintain a very low profile, swimming close to the shore or under water to escape observation, or run up the bank and into the forest in a panic. The surveyor's best option is to travel slowly and to stop immediately on sighting the animals by steering the boat into the bank furthest from the otters. On wider rivers, although giant otters are less likely to escape onshore, by swimming downriver with the current they easily manage to evade the surveyor who has to react by manoeuvring the boat (sometimes a slow process). The best option in this case is to continue upriver, or to wait, and to paddle downriver with the inflatable boat, in the hope of catching up slowly with the otters. Surveyors should never attempt to follow and catch up with an otter group at high speed; this is guaranteed to frighten the otters badly. On rivers, it is also more likely that a group may become split up, with individuals adopting different escape routes. Cubs are slower to react and may become confused, not knowing who to follow; in any such scenario, attempts to follow and film individuals should be abandoned immediately to allow the otters to reassemble.

It is rare to successfully film all the members of a group of otters on a single occasion. This is particularly true when the group is large, so repeated efforts may be necessary. Transient individuals rarely periscope, unless taken completely by surprise. Also, they are often encountered only once, before they move on; it is therefore difficult to obtain their throat patterns. It is also difficult to know from one sighting, whether a solitary individual is truly transient and not a member of a group temporarily by itself.

Successive population censuses will reveal which otter groups are associated with which territories, so that, as the surveyor enters a known territory, one can expect to recognise the resident family (SCHENCK and STAIB 1998, GROENENDIJK et al. 2001). However, the identification of one known animal in a group is not sufficient to characterise the whole group. That individual may have left its parent group (with which the surveyor is familiar) as a transient and may have joined an unknown family as a replacement for one of the reproductive pair, thereby misleading the surveyor into believing it is still the original group. Or, if only one or two individuals of a group are filmed on one occasion, and on a second occasion two different individuals of the same group are filmed, it is easy to make the mistake of believing that two different groups were encountered. To avoid such errors, the surveyor should aim for a 100% identification of individuals, but obtain a minimum of 60% of neck markings per group in order to identify it.

Counting individuals

Local people will very often tell the surveyor that the river or lake being investigated is inhabited by many giant otters or that several groups share the same territory. When a large family of giant otters is first encountered, it is easy to gain the impression that there are at least twenty animals. Giant otters, particularly transient individuals, may travel large distances (tens of kilometres) within a short space of time. Groups may split up into smaller sub-units for short periods. It is therefore not uncommon for people to mistakenly assume that more than one group is present, or that a different group has been found to that seen the previous day. Moreover, local people sometimes believe that group size is maintained year after year; if a family of ten individuals is regularly seen over a period of weeks or months, then in subsequent months or even years, they will tell the surveyor that the group is still composed of ten members when in fact there may have been any number of changes in group size and/or composition.

It may be argued that if the animals are distributed along a longitudinal survey stretch (a river) and the distance between two groups is much larger than the average size of the territory of one group, identifying each individual may not be necessary because we can safely say that the two groups are different. However, this requires a detailed and accurate knowledge of the size and/or length of giant otter territories in a wide variety of habitats (what little published data we have suggests that territory size is highly variable), and also the certainty (which we do not have) that otter groups never trespass on each other's territories. If two groups are sighted on the same day and the surveyor has been travelling continuously in one direction only, it is possible that the same group has been encountered twice. This is especially true on meandering rivers where giant otters may use cross-over points to avoid travelling long stretches by river. Groups which have cubs cannot travel large distances in a single day. However, transients are not hampered by others and especially when moving downriver may cover large distances in a single day. Even if the number of individuals per group is different in two separate sightings, it could still be the same group as it is easy to miss some members during a sighting. Total number of otters per group is not a criterion for group identification. If less than 60% of throat markings are obtained per group, two different sightings of groups must be spaced at least 40km apart, for the groups to be considered different.

While one person is filming, the other concentrates on repeatedly counting the otters, simultaneously assisting the filmer by positioning the boat and by pointing out which animals are hanging back. The number of individuals recorded is the total number of heads that are seen *together* above water at any single moment, or the total number of different neck markings filmed after an encounter. Thus if four individuals are seen simultaneously at one point, and the surveyor strongly suspects there is another, but all five heads were not observed out of the water together, then the census total for the family should be noted as $\Sigma \geq 4$, indicating that a minimum of 4 individuals was encountered.

If the group is large (say, 8 individuals or more), it can take an experienced surveyor several days to establish with complete certainty the total number of individuals. Counting does not necessitate a periscoping situation; in fact, it is best achieved by watching a group from a distance as the members go about their normal activities (e.g. when they go ashore). Sometimes, when group members move from one hunting area to another, they will do so over open water, or in a line along a river bank, in which case their heads may all appear above water level simultaneously for a few seconds.

The majority of cubs are born during the dry season, but wet season litters are occasionally seen so it should not be assumed that there are no cubs simply because it happens to be the wrong time of year for them. If it is suspected that the group has a litter of cubs (for instance, because the group returns to the den more frequently, the female entering to nurse the cubs inside), or if the survey is being conducted during the dry season, extra care must be taken when approaching or investigating dens. Surveyors must not go ashore. The family is usually much more nervous and it is possible that, when continuously disturbed, the female may stop lactating due to stress (this has been recorded in zoos; WÜNNEMANN 1993) or the group may feel forced to abandon the den and move their cubs elsewhere, thus exposing them to danger.

Recording throat markings

Otters tend to be very aware of the presence of people, and will usually approach a boat in much the same way as they would a large predator such as a caiman. It is rare, once a group of otters has seen a boat, for the latter to be ignored. Normally, group members will surround the boat, periscope and repeatedly utter explosive warning snorts. Some groups are by nature much more wary than others; individual characters, particularly of the reproductive pair, and previous experiences with people appear to play an important role in group reaction. In certain areas in Bolivia (for example, Isiboro-Secure National Park), giant otters have developed a marked skill in avoiding boat contacts and to remain invisible in areas with intensive fishing boat navigation (VAN DAMME pers. comm.). In other places such as the Guianas and in the Pantanal, Brazil, groups may be comparatively relaxed in the presence of people.

When a group is exposed to people only very occasionally, then periscoping behaviour is usually vigorous and may last several minutes. In habitats where local people fish relatively frequently, the 'display' may be of very short duration before the animals disappear. Sometimes a group may begin to periscope while people are still hundreds of metres away; they may not even have seen or heard it but may have smelled it. Such a reaction suggests an association by the group with a negative experience. Generally, the longer the periscoping display the less experience the group has of humans; it is expressing both curiosity as well as alarm.

There are two options to record throat patterns: filming and photography. Filming is carried out with a handheld digital video camcorder which has a powerful zoom (at least 20x optical zoom) and a long-life battery. Spare battery packs are essential; batteries may discharge rapidly in the tropics. Many people find capturing giant otter throat markings with a video camera much easier than with a still camera as it is unnecessary to get so close to the otters, a video camera is more forgiving of shake, and continuous footage is obtained. Some surveyors, however, prefer to use a semi-automatic still camera with auto focus (100% automatic cameras are fragile). Still cameras have the advantage of not requiring bulky batteries, so carrying spares or re-charging (in areas where there is often no electricity) is not a concern. Sorting through photographs is much easier and less time consuming than watching many hours of film footage. Also, comparing animals is simpler if one can place images side by side. However, if there is room in the budget for *either* a video camera *or* a still camera, then it is recommended to purchase a video camera because the main priority is high efficiency in capturing throat patterns.

There is a marked peak in giant otter activity in the morning, between 7 and 10am. There is also a less pronounced peak in aquatic activity in the late afternoon (LAIDLER 1984, CARTER and ROSAS 1997, STAIB 2002). These are therefore the best times to try to encounter otter groups and are also when light conditions are most appropriate for filming. Harsh light at midday, and the resulting sharp contrasts, may cause light to be reflected or shade to be cast under the throat so that markings lose definition and appear deceptively larger or smaller. In such conditions it is necessary to under- or over-expose (respectively) in order to 'enhance' the neck markings. Extensive use should therefore be made of the contrast adjustment facility on the video camera. Polarising filters can be used with still cameras. It is important also to remember to record frontal angles as much as possible since it is sometimes difficult to correctly identify individuals from footage filmed from the sides.

Some individuals periscope vigorously and are easily filmed while others hang around at the back and may not periscope (e.g. cubs). It is tempting to keep focusing on those animals which are periscoping most actively, but once these have been filmed satisfactorily it is important to quickly seek out the more subdued members of the group as there may be only one opportunity to obtain their throat markings. Small cubs are unable to periscope and their markings must be filmed at a later date or when ashore. When a group first approaches, a wide field of vision is used to capture as many periscoping individuals in one frame, and then the surveyor zooms in to specific animals to obtain detailed close-ups. As the encounter progresses, the animals periscope less frequently, until eventually they will move away. Optical equipment should always be stored in a waterproof container with silica gel when not in use (e.g. at night). Filming is possible in light drizzle under a protective covering.

2.7 Avoiding Negative Impacts on Giant Otters

It is obvious that a degree of disturbance is inevitable (particularly during sightings); this should be recognised by surveyors. Clearly, minimising negative impacts on giant otters is important, not only for the animals but also for surveyors since opportunities for observing otters is maximised. Therefore, any extreme reactions – prolonged disruption of daily activities (e.g. hunting); immediate departure from the area; temporary separation of members from the main group; abandonment of a den – must all be avoided. In addition to always allowing an escape route, care should be taken to minimise impact and stress when investigating dens and campsites, or during sightings. The first step is to prevent repetition of actions that cause disturbance, i.e. to be as efficient as possible. The second step is to either avoid being observed by the otters in the first place, or to reduce the length of time that they are aware of the surveyor's presence. Other precautions are already detailed under headings above.

Although otters are generally not very bothered by the smell of people on or near their campsites, they have been known not to re-use their den after having discovered that it has been disturbed. When approaching from the water to investigate what appears to be a fresh den, the shore underneath the den entrance is first examined from a distance with binoculars to discount the possibility that the family is in the den at that moment. A confrontation at close quarters will be avoided if the soil is checked for wetness, extremely fresh tracks leading up from the water's edge to the entrance, and/or the absence of belly slide marks coming out of the den. Also, when otters enter a den they sometimes scrape the earth at the entrance so that a layer of fresh, dry, crumbly dirt is scattered below; this is useful as an indication that the otters are inside the den. On exiting, the dirt layer is rapidly flattened and mingled by the otters. To ensure that the giant otters are not in the den or to give them the possibility for escape, the surveyor should make a noise while approaching.

When it is not the breeding season and once the surveyor is positive that the otters are not inside the den, a closer investigation can be made. However, walking on very fresh (and therefore possibly still active) den sites must be avoided as much as possible. The surveyor should enter the den site with gloves and shoes (both to avoid leaving much of one's scent as well as to avoid infection by parasites such as hookworm), and on completing the investigation, water should be scattered over areas that have been touched to erase human odours. Water, or carefully placed twigs, are also aids to determining whether the otters have returned to the den or campsite since the surveyor last visited it (as indicated by fresh tracks or displaced twigs). A general guideline is to spend as little time as possible at den sites, and not to take measurements (e.g. of the den entrance) that are unnecessary for the purpose of the survey or census.

2.8 Logistics

Paddling a robust, two-person inflatable, plastic, aluminium or wooden canoe is the preferred survey method since this allows plenty of opportunity to survey shores and also minimises impact. However, travelling (upriver) with the aid of a motor is unavoidable in faster flowing currents or when covering greater distances. Heavy dugout canoes cannot be carried overland, whereas aluminium or plastic boats may be carried short distances. An inflatable boat can be transported overland for several kilometres.

Essential Survey Equipment

- A motor-powered, wooden or aluminium canoe/boat for transport along rivers. The length of the boat is determined, amongst other factors (e.g. duration of survey), by the type of river to be surveyed, with shorter boats or canoes being more manoeuvrable in narrow, shallow rivers, especially during the dry season. In Peru, for instance, a 15m wooden boat and 55HP outboard motor is used to cover large, non-survey distances, while an 8 or 9m wooden canoe with a 16HP outboard (peke-peke, in combination with a silencer to reduce noise levels.) is used to survey narrower rivers. When actually carrying out the survey, only a low-power motor is necessary. In other areas, two-stroke outboard motors are used (15 or 25HP). Nowadays, there are also four-stroke boat engines available which are considerably more silent than the traditional outboard. They are more expensive, but they consume less gasoline and do not require oil. In some habitats (such as the Amazon or Paraguay Rivers) a high-side boat in which the surveyor can live and comfortably travel long distances may be more useful for transport. Diesel is also cheaper than petrol. A combination of boat types may be necessary during a single survey.
- A two-person, robust, stable, inflatable boat (not the swimming pool type) for use on lakes or paddling downriver. An inflatable boat is used to survey slow-flowing streams and lakes (since it can be easily carried overland in a backpack frame). Stored in a spine/tear resistant canvas bag. Lightweight paddles. A pump for inflating the boat plus a spare. A suitable kit to repair punctures, with extra adhesive.

- A handheld GPS receiver (that can be linked to a computer to download the data).
- A digital video camcorder or mini-DV with a powerful zoom (20x or 30x) and at least two long-life batteries (single batteries lasting up to 16 hours are now available at reasonable prices). Spare cassettes and battery re-charger. Digital gives better image quality and images can be sent to a computer, frozen and manipulated.
- Semi automatic camera with 300mm+ telephoto zoom lens, fill flash, and 300/400 ASA film.
- A pair of good quality binoculars (10 x 40-50) preferably waterproof.
- A robust, waterproof storage case and plenty of silica gel for all optical and electrical equipment.
- Maps (laminated and as up-to-date as possible) to the scale of 1:100,000 or lower (e.g. 1:50.000) should be used, if available for the survey area.
- A satellite photograph or detailed map of the survey area will help to avoid loss of time (through attempting to locate non-existent water bodies).
- Notebooks, pens, pencils, felt markers, tape measure.
- Throat pattern catalogue (if one has been assembled).
- Laminated Field Tips sheets (Appendix 2).
- Survey data collection reports (including one laminated copy) (Appendix 4).
- (Optional) Secchi disc, to measure water transparency.
- (Optional) Tape or rope marked at 1m intervals to measure water depth.
- (Optional) Handheld range finder to measure distances (e.g. river width).

Survey equipment sources

Binoculars -	Nikon: Zeiss: Swarovski:	*www.nikon.com* *www.zeiss.com* *www.swarovskioptik.com*
Video and camera -	Sony: Minolta: Canon: Nikon:	*www.sony.com* *www.minolta.com*, *www.minoltaeurope.com* *www.canon.com*, *www.usa.canon.com* *www.nikon.com*, *www.nikonusa.com*
Inflatable boat -	Zodiac: Grabner:	*www.zodiac.fr* *www.grabner-sports.at*
GPS -	Magellan: Garmin:	*www.magellangps.com* *www.garmin.com*
Waterproof case -	Pelican:	*www.pelican.com*

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3. The Range-wide Distribution Survey Strategy (RDSS-GO) and the Standard Distribution Survey Method (SDSM-GO) for the Giant Otter

Introduction

Documentation of past, present and potential future distributions of species is a vital tool for an understanding of their conservation status, for priority setting, and for planning species oriented conservation programmes (HIRSCH et al. 2002). Although hunting for the pelt trade, the greatest threat by far between 1940 and 1970, is a thing of the past, habitat degradation and destruction are currently impacting giant otter populations. An important way of measuring these impacts is by monitoring the giant otter's distribution status. Therefore, during the first Giant Otter Field Survey Techniques Standardisation workshop in Peru, it was proposed to develop a *Range-wide Distribution Survey Strategy for the Giant Otter* (*RDSS-GO*), in parallel with the standardization of field survey techniques.

The current general lack of (trained) manpower, resources and expertise, the enormity of the giant otter's range, the inaccessibility of many areas, and the urgent necessity to conduct surveys sooner rather than later, have led us so far to place emphasis on carrying out surveys in some priority areas, often on a local/regional basis. However, we believe that designing a *range-wide* distribution survey strategy, that is also applicable at the regional or national level, will strengthen these initiatives while simultaneously allowing the detection of range-wide giant otter distribution trends on a long-term basis.

Carrying out distribution surveys on a national and/or range-wide basis, over time, will:
- allow the visualization of changes in the extent of distribution,
- shed light on actual and perceived threats to the species by allowing us to overlay giant otter distribution data/maps with human activities data/maps.
- provide comparative data for ecological studies.

These, in association with other tools and information, in turn will:
- allow the evaluation of the distribution and population status of the giant otter and trends therein (in terms of expansion rather than abundance),
- indicate the types and extent of conservation measures needed and elaborate a priority list of actions,
- demonstrate the effectiveness of implemented conservation measures, (on a large scale),
- point to temporal ecological changes in ecosystems (using the giant otter as an indicator species),

Furthermore, reliable and up-to-date distribution data will encourage backing for future funding proposals as well as promote trans-border cooperation at different political levels. Thus, giant otter distribution survey data can be used as a tool for conservation decision makers including international conservation bodies (IUCN), protected area managers, policy makers, NGOs focusing on biodiversity conservation, amongst others.

Because there are limited resources for surveys, researchers and surveyors working on a more detailed level should try to include the aspects of the RDSS-GO into their study design, to be able to contribute their data to the range-wide distribution database and to avoid duplication by other surveyors.

The Standard Distribution Survey Method (SDSM-GO)

A range-wide distribution survey strategy will be strengthened if it is based on standardised survey methods and data collection/storage. A preliminary discussion paper describing a possible standard distribution survey method was the product of the second field techniques standardization workshop held in Peru, and a National Giant Otter Survey Strategy workshop held in Bolivia in August 2003.

Following is a summary of discussions at the Range-wide Giant Otter Distribution Survey workshop held in the Brazilian Pantanal in December 2003, as well as of subsequent comments on a second draft of the original preliminary paper. Guidelines for a standard distribution survey method are outlined. It is important to highlight, however, that many require testing in the field and that the strategy is therefore fully expected to evolve with time and experience in order to better meet its objectives.

Grid size

Grid size should be chosen with a view to potential results and should be based on clear objectives (e.g. revealing distribution patterns), for which it will be necessary to repeat surveys. A compromise has to be sought between accuracy (the certainty that data reflect real distribution patterns) and feasibility/efficiency (in terms of financial and time costs of surveys), or, in other words, between pragmatism and scientific demands.

A larger grid base will have to be used if we are at all likely to successfully carry out distribution surveys beyond the local level. Yet grid size should not be so large that gaps where giant otters are absent do not become evident; we are, after all, arguably more interested in those areas where giant otters no longer occur than where they are present. Larger grid sizes may result in a more optimistic representation of distribution range. Time considerations are also important when selecting grid size. A range-wide distribution survey completed every 20 years because it is based on a small grid size is less useful than a large grid completed after 3 years.

For the range-wide distribution survey strategy, a grid base of 100x100 km is proposed (see Figure 68). Each square of the grid therefore represents 10,000 km². On the range-wide level, a 100x100 km grid provides the most practical choice considering the financial and time cost associated with surveying an area the size of South America. However, *a range-wide 100x100 km grid base will over-represent giant otter distribution considerably.* By way of example, Figure 69 shows the influence of grid size on distribution representation for the Eurasian otter (*Lutra lutra*).

Selection of quadrants within grid squares

Grid squares of whatever size may be divided into smaller units known as quadrants. It was decided to divide each square of 100x100 km into four quadrants of 50x50 km, each of which is divided into four subquadrants of 25x25 km giving a total of 16 sub-quadrants of 25 km x 25 km (see Figure 70). In practice, ***the SDSM-GO recommends surveying <u>one</u> subquadrant of 25x25 km within each 100x100 km square***. The choice of the sub-quadrant depends on prior knowledge of the surveyor, who should decide where the probability to encounter giant otters is highest (based on habitat suitability, local knowledge, etc.) and where the feasibility of returning to the same site in future surveys is the greatest. The distribution survey will be conducted only in this sub-quadrant. If the giant otter is encountered in the sub-quadrant (by direct sighting or sign), the 100x100 km square is 'positive' for the species. If not encountered in the subquadrant, the square is 'negative' for the species.

Although ***it is recommended to return to the same sub-quadrant in survey repetitions***, this is not necessarily possible (for logistical or security reasons) or appropriate (for instance, if the likelihood of encountering giant otter sign is much higher elsewhere). In such cases, sub-quadrant choice may be different in future surveys, with the resulting limitation that a wider distribution in a second survey may reflect an improvement in surveyor skills/knowledge as well as (or instead of) an expansion in the distribution.

Refining the SDSM-GO

The advantage of the described approach is that it allows the possibility to refine the survey on an individual basis. The next example is one of a first-step refinement: the standard squares of 100x100 km can be divided into four squares of 50x50 km. ***For surveys***

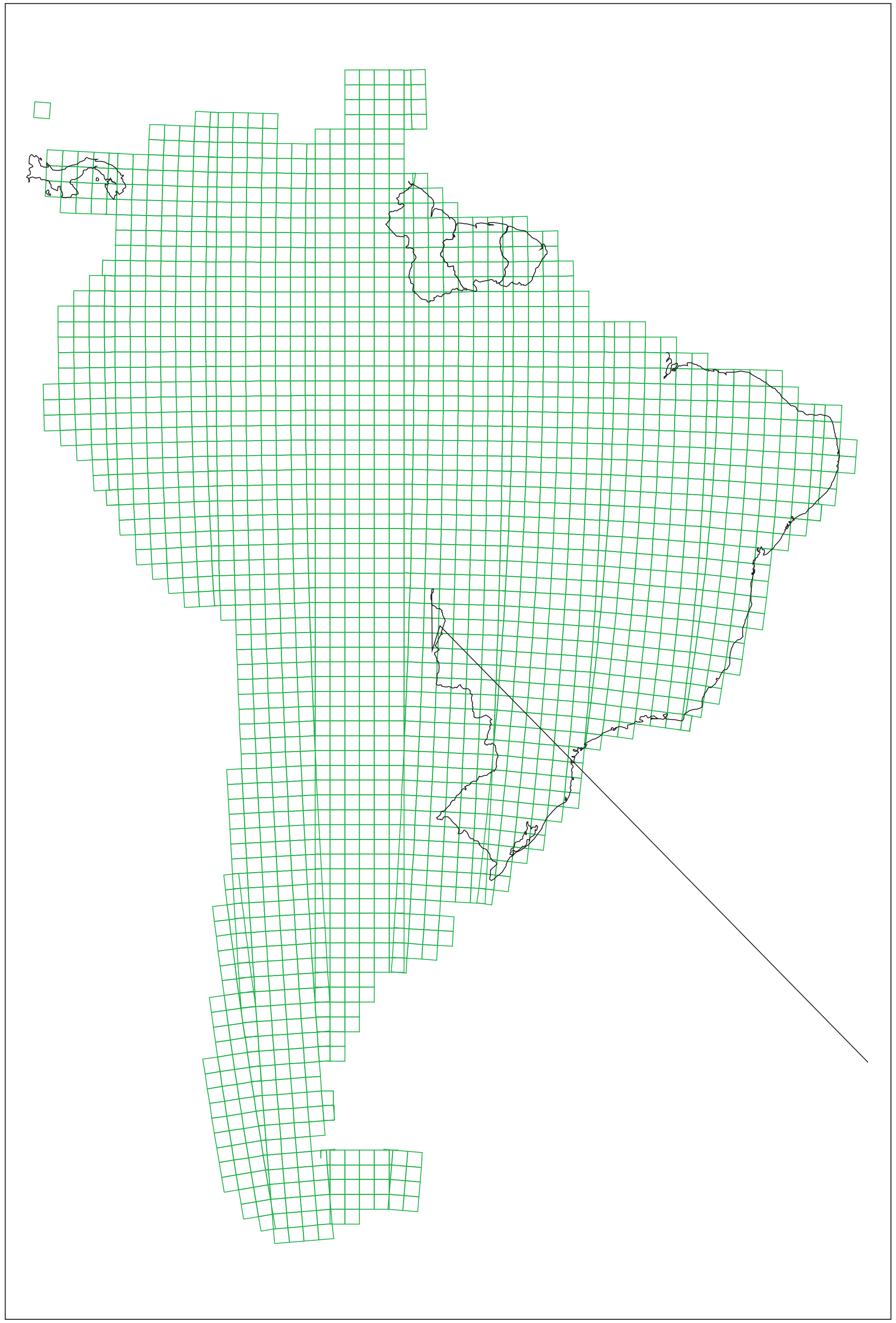

Fig. 68: 100x100 km UTM grid for South America.

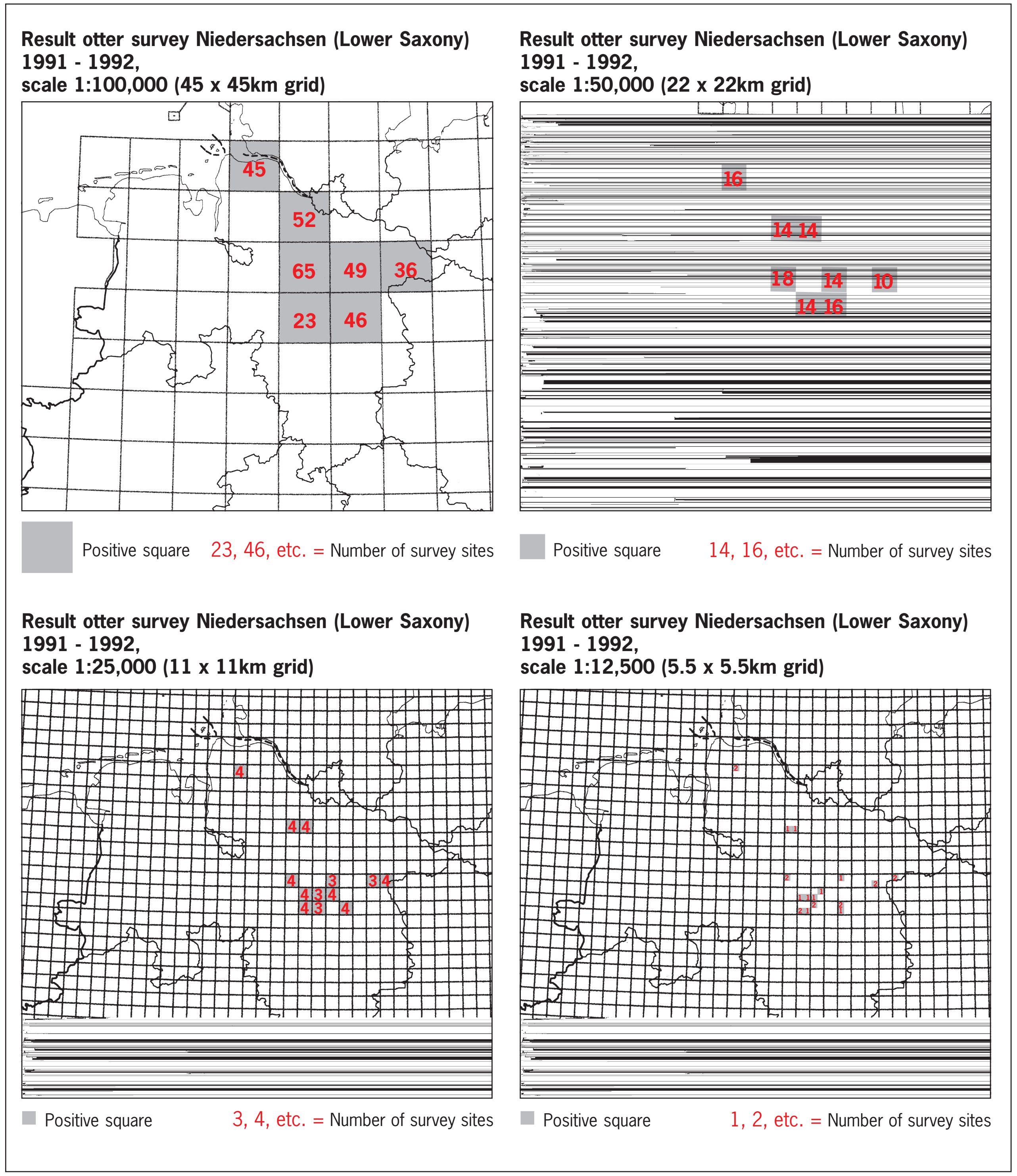

Fig. 69: Influence of the scale of grid used for the presentation of results of the otter survey for the German federal state of Niedersachsen (REUTHER et al. 2000).

view, because of the higher chance of finding giant otter signs when a survey site is visited more frequently. However, from a pragmatic point of view, and keeping in mind the rough level of a survey based on a 100x100km grid as well as the need to have basic information, it does not make sense to record only one of the repeated visits to the 'range-wide survey site', and if this is negative, to ignore evidence of otters which was found during former visits. To ensure accuracy (and to enable future analysis), it should be stated in the survey and finding report that the result is based on repeated visits, and information on the total number of visits, their periodicity, and their results should all be detailed.

Similarly, a 100x100 km square should be counted as positive as soon as one giant otter sign is found – irrespective of how many other sites were surveyed or where they were located within the square. It should be counted as negative if no giant otter signs were found

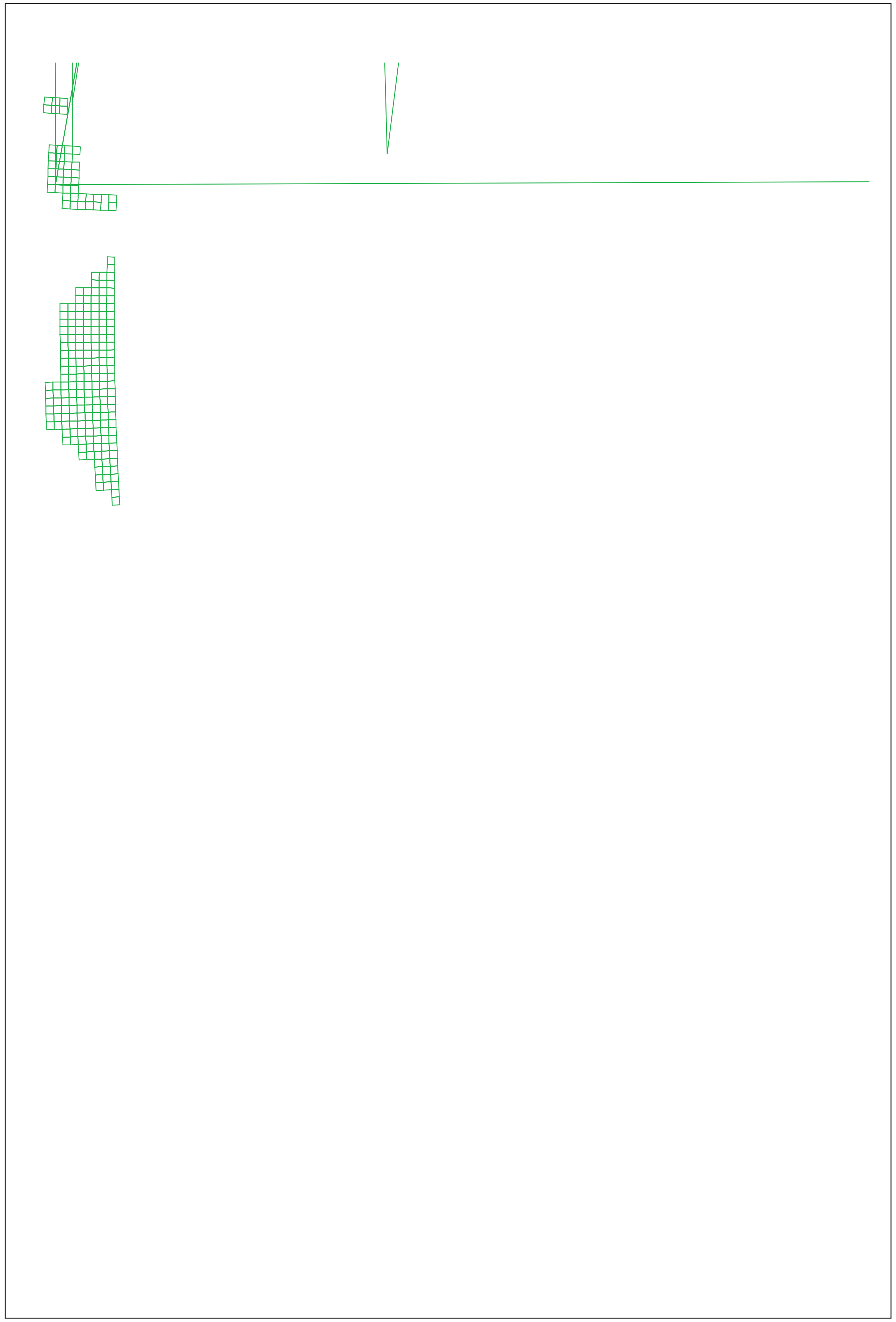

Fig. 71: 50x50km UTM grid for South America.

Fig. 70: The division of a 100x100 km square into 16 sub-quadrants of 25x25 km.

Fig. 72: First-step refinement of the SDSM-GO.

Fig. 73: Second-step refinement of the SDSM-GO

– irrespective of the number of sites surveyed and their location in the square. Again, additional information (the number of extra positive/negative sites within a square, inclusive their coordinates), should be reported to facilitate future (local) comparisons.

If the survey site is negative but a giant otter sign is recorded elsewhere in the sub-quadrant, then this should be noted as Accidental field data (see **Appendix 4**, section A).

Figure 74 illustrates how a 25x25 km sub-quadrant is identified in a 100x100 km square. The red cross is the survey site. Maps provide the Grid Zone Designation (this is found in the legend in a blue/violet rectangle or grid reference box, on the left-hand side). The Grid Zone Designation consists of two digits and one letter and refers to the UTM Zone. The 100,000 m Square Identification is also given; this explains which 100 km squares are (partially) covered by this map, using two letters. In the first diagram below, a 100x100 km square is shown with Grid Zone Designation 19L and Square Identification EG. So far, this is an internationally recognised system. What follows is the standard established for the purpose of this document. In the second diagram, the 100x100 km square has been divided into four 50x50 km quadrants. These are always labelled A, B, C and D, in the manner shown. In other words, when we refer to quadrant C, we know that this always means the quadrant in the bottom, left-hand corner of the 100x100 km square. In the third diagram, each 50x50 km quadrant has been divided into four sub-quadrants, always numbered 1 to 4 for each letter, in the order shown. So sub-quadrant 2 is always in the top right hand corner of a quadrant. Therefore, in the example below, the full code of the location of the survey site is 19L-EG-B3.

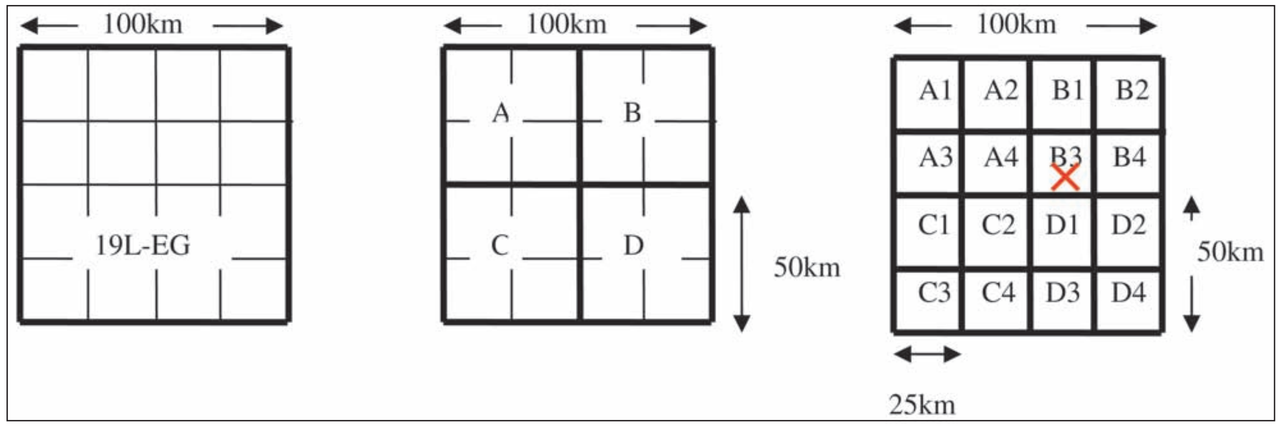

Fig. 74: Identifying a 25x25 km sub-quadrant.

downstream.

Areas which are logistically difficult to survey in the quadrant, such as marshes, should not be included in the choice of sites. The fact that a river is in a remote square or quadrant, however, does not mean that it should not be surveyed.

In summary, **square and quadrant selection is carried out on the basis of the SDSM-GO grid and with the use of national maps. Sub-quadrant and survey site choice is finalised with information from the field which determines the highest likelihood of encountering giant otters or their sign, and the greatest probability of returning to the same quadrant/site in survey repetitions.**

How to handle irregular-shaped units in the border areas of UTM zones The treatment of irregular-shaped units in the border areas of UTM zones (see Figure 75) is influenced by the premise that a distribution survey on the accuracy level of a 100x100 km grid should mainly follow pragmatic considerations. Therefore, all shapes covering a surface area of more than 2500 km 2 (= surface of a 50x50 km quadrant) should be handled as though they are 100x100 km squares, and the results presented as such in the distribution database/maps. Shapes covering a surface area of less than 2500 km2 should not be included in the survey (and will therefore not contribute a survey result to the distribution database/maps). Irregular-shaped units should not be subdivided into quadrants; rather, a survey site should be selected within the whole shape.

How to handle squares which include national borders To save money and time, it is recommended not to double-survey 100x100 km squares that cross national borders. Surveyors from the neighbouring countries should agree on who will survey which of these squares; in most cases, the country with the necessary funds and/or which holds the majority of each square's surface should undertake the task.

Survey distance and bank At each survey site **measured distance) should be surveyed, using the Standard Field Survey Techniques**, the most probable bank **the survey stretch should be as continuous (connected) as possible;** A survey site can comprise river bank, lake bank, creek bank, island bank, etc. which are connected or not connected. However, adequately completed along one continuous bank, then

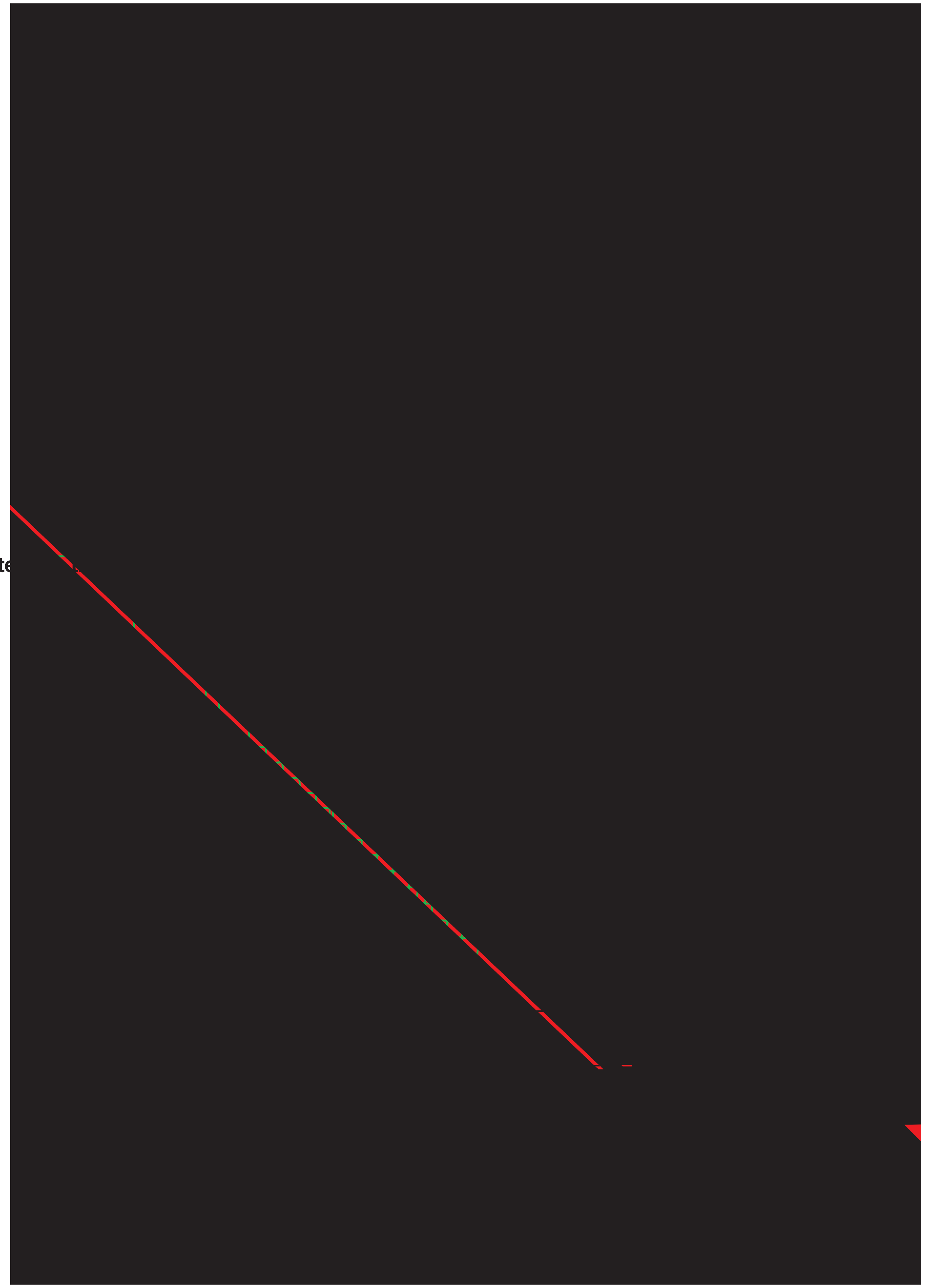

Fig. 75: Similar to Fig. 44 in Habitat 12 but for 50x50 km South America UTM grid.

the survey distance should be complemented with an additional likely stretch which is as nearby as possible (and within the same sub-quadrant!). All start- and end-points should be recorded by GPS so that the same survey site can be investigated in survey repetitions. However, only start-points will be entered in the ISOS databank.

During surveys, the boat should be a maximum distance of 10m and a minimum distance of 2m from the shore in order to aid identification of sign.

'Stop-at-first-sign' versus full distance surveys

When giant otter sign is found at any point within the standard survey distance, the site can be treated as positive and abandoned. This is known as a 'stop-at-first-sign' survey and is the minimum for the SDSM-GO, in order to establish presence or absence, while maximizing time and financial resources as well as the number of surveys that can be undertaken within a given period. However, surveyors may be disinclined to halt a survey when it has taken a week to organize it and to arrive at the starting point. Therefore, though not required as a standard, it is recommended to investigate the full survey distance even if the site is found to be positive at an earlier stage, in order to collect additional data for specific studies (e.g. for the evaluation of the SDSM-GO) (REUTHER et al. 2000).

The surveyor should *always* record the distance at which the first sign was encountered irrespective of whether it is a stop-at-first-sign or full distance survey (these data will eventually help us define the ideal survey distance). This means that the GPS receiver has to be left on for the duration of each survey, so that actual distance along the bends of the river is measured (using the odometer function) instead of a straight line between the start-point and first sign.

Boat speed

A minimum of two surveyors and one boat-driver should scan shorelines for indirect and direct giant otter signs. The boat should be paddled, or propelled by a small outboard motor, preferably as silently as possible to minimize disturbance. ***It is recommended that 10 km/hour be the maximum survey speed***; slower may produce better results but this depends on habitat type.

Seasonal timing

Timing of the distribution survey is critical. If a river or lake is surveyed only once a year, or less frequently, then it is important to do so when water levels are low and rain is infrequent so that dens and campsites are more easily encountered, recent activity is not erased, and the animals themselves are more restricted to permanent water courses. However, it may prove necessary to avoid the height of the dry season, since water levels can be so low as to make navigation problematic. Generally, *it* ***is recommended to conduct the distribution survey in the period of intermediate water levels (at the end of the wet season / beginning of the dry season*** when banks are becoming exposed and little rain is expected). The best period in each locality, however, is to be decided by the surveyor, taking into account local climatic and hydrological conditions. **Specific (e.g. regional) survey repetitions** ***should preferably be conducted over the same order of time, and at the same time of year (or when water levels are similar), as former surveys in the same area.***

It is suggested to initiate a survey day in the early morning after first light and to finish before sunset (to avoid low light conditions which make it difficult to distinguish giant otter sign from amongst the vegetation and bank features). Although giant otters are active throughout the day, there is a peak in activity between 7 and 10am and a less marked increase in the late afternoon (DUPLAIX 1980, STAIB 2002); these are times when giant otters are encountered most frequently. A break is recommended around midday, to maximise surveyor ability to identify signs.

Data collection report

The model for a giant otter survey and finding report (**Appendix 4**) requires further testing in the field; please send any comments to the first author of this document.

Findings from accidental field (non-survey) reports, questionnaires, and/or from publications can also be recorded in the survey data collection report. However, it is suggested to restrict these to post 1990 data.

tant consideration; gold mining, logging, guerrilla or drug activities may make it inadvisable to survey some headwaters or regions.

The Range-wide Distribution Survey Strategy (RDSS-GO)

So far, we have addressed the Standard Distribution Survey Method and how it can be applied to all surveys, whether their basis is the 100x100 km, 50x50 km, or 25x25 km UTM grid. Following is a discussion of the Range-wide Distribution Survey Strategy (RDSS-GO), based on the standard 100x100 km UTM grid.

Periodicity of surveys

Ideally, ***a range-wide distribution survey should be initiated every 7 years, with each range-wide survey being completed within a maximum time period of 5 years*** (the first 5 years of each survey cycle). During the last two years of each cycle, data can be analysed, interpreted and published (see Figure 76). It seems unrealistic at this stage to establish a tighter schedule. However, the time frame of 7 years should be evaluated in due course because important giant otter distribution changes might occur within shorter time intervals.

Fig. 76: Periodicity of giant otter range-wide surveys.

Prioritisation of areas

Since funds and time are the two main limiting factors, and since the giant otter's range is so large, it will be necessary to prioritise areas in order to obtain the best value (the most useful information in terms of furthering giant otter conservation) for money and effort invested, in as short a time frame as possible, but on the understanding that all other areas will also be surveyed eventually.

A number of possible methods and criteria for prioritising areas on a *national* basis have been proposed; from developing giant otter distribution maps based on post-1990 locality data identified in publications or in reliable verbal reports, to defining hydroecoregions within which criteria such as geomorphology and climate predict squares where giant otters are most likely to occur (VAN DAMME and ZAPATA 2003). Combining this information with data on human influence and level of ecosystem protection may provide a priority list of areas.

During the Pantanal meeting in December 2003, the following possible criteria for prioritising squares were discussed, in order of importance:

- Border areas of known populations
- Populations which are isolated
- (Potential) corridors between populations
- Existing work areas
- According to existing data or where we have none (preliminary maps)
- According to human presence / roads / industry

Three preliminary priority regions were identified, largely on the basis of existing work areas and the availability/willingness of existing teams to carry out distribution surveys in these areas. The three regions are:

- the corridor between the Department of Madre de Dios in south-eastern Peru, through Bolivia, to the Pantanal in Brazil;
- the southern portion of the Guianas, on the border with Brazil;
- the Tocantins and São Francisco River watersheds in Brazil.

It was also argued that Brazil is the most important area for giant otters, covering more than three quarters of the species' range. We still have only very limited information on giant otter distribution in Brazil so surveys should concentrate in the first case in large transects over the Brazilian Amazon basin rather than at the edges of distribution in the west.

However, since we are defining a *range-wide* strategy for giant otter distribution surveys, and since we require basic data for the whole of the current distribution range, here we should be looking at defining guidelines for identifying areas on an international scale, rather than on a national/regional level. With this in mind, ***greatest priority should be given to the border areas of the estimated species range and to potential corridors between isolated populations.*** Even if in the short term it will be very difficult to send surveyors to some of these regions, the fact that they are listed as priorities should help to focus future survey effort there (this was one of the objectives of the 1990 Otter Action Plan, to highlight geographical areas and scientific themes which required further investigation).

It is therefore proposed to categorise priority areas as follows:
A-1: border areas that can be realistically surveyed,

A-2: border areas that are currently difficult to survey (e.g. for security reasons),
B: (potential) corridors between known populations,
C: imminent/actual threat areas (e.g. gold mining areas).

In order to define the border of the giant otter's current distribution range, it is further suggested to survey two squares (together representing 200km) to either side of the estimated border line (see Figure 77). Clearly, altitude and other topographical barriers will override this criterion (it does not make sense to survey a 100x100 km square at an altitude of 1000m above sea level where giant otters are known not to occur). ***Surveys should be restricted to the original distribution range of the species*** (Figure 78).

Each country in the giant otter's distribution range should design a *national distribution survey plan* which follows the general guidelines of the RDSS-GO. The existence of national distribution survey plans that fit within the overall strategy could focus future efforts and would increase cost- and time-efficiency.

Personnel aspects

In general, it has been recommended that surveys be carried out by as few different surveyors as possible in order to reduce any biases due to differing skills and interpretations (REUTHER et al. 2000). In South America, there is no 'risk' that hundreds of people will enter the field to conduct surveys. On the contrary, the urgency for surveys and for people to carry them out still needs to be recognised and addressed. However, wherever possible, ***repeated surveys of the same area at the same time of year should be conducted by the same surveyor(s).*** These surveyors should have prior experience in the field, or should be accompanied by an instructor who is familiar with giant otter sign identification and ageing, filming throat markings, etc., for at least two weeks during an initial field training period (see Appendix 7 for Preliminary Notes on Selecting/Capacitating New Surveyors).

Local (especially indigenous) people should be involved and trained as much as possible during survey and monitoring activities. Not only is their knowledge of the environment useful to negotiate difficult terrain and to help identify giant otter signs with which they are often familiar, but active local involvement also develops personal identification with the species. A questionnaire has been designed (see **Appendix 5**) which can either be completed in person, or with an interviewer guiding the conversation. Conversations with local people are often revealing, although details such as the number of otters within a group or the number of cubs born during the year should be treated with caution for the reasons mentioned previously (and are therefore not addressed in the questionnaire). It is not advisable that *only* local people be held responsible for the carrying out of a survey or census, *unless* they are suitably experienced / trained.

The Information System for Otter Surveys - ISOS

A range-wide distribution survey strategy only makes sense if data is (a) collected in a standardized format, to ensure reliability and comparability – this has been addressed, and (b) stored in a user-friendly database for accessibility by all appropriate actors. To make comparable distribution data constantly available on both a national and international level is the prime argument for a standardisation of the survey method. So far, standardisation efforts have been generally limited to the collection of data, with little development of ideas as to how data can be stored, processed, or made available.

The German Association for Otter Protection (Aktion Fischotterschutz), in cooperation with the IUCN/SSC Otter Specialist Group, has developed a computerised system to store, process, and supply data related to the distribution of all otter species in a standardised format: The Information System for Otter Surveys – ISOS (see Figure 79).

Fig. 79: Logo of the Information System for Otter Surveys – ISOS (REUTHER et al. 2000).

Storage of data

In most countries, distribution data are collected by numerous agencies, organisations, or private persons, each using their own format for data storage. This not only prevents the compatibility and comparability of the data, it also reduces the completeness of single data sets and entails the risk that complete data collections are lost.

One obstacle for centralised data collection, as is well known from many surveys for different species, is egoism or personal ambition. There are always people who fear that their personal contribution to a databank is

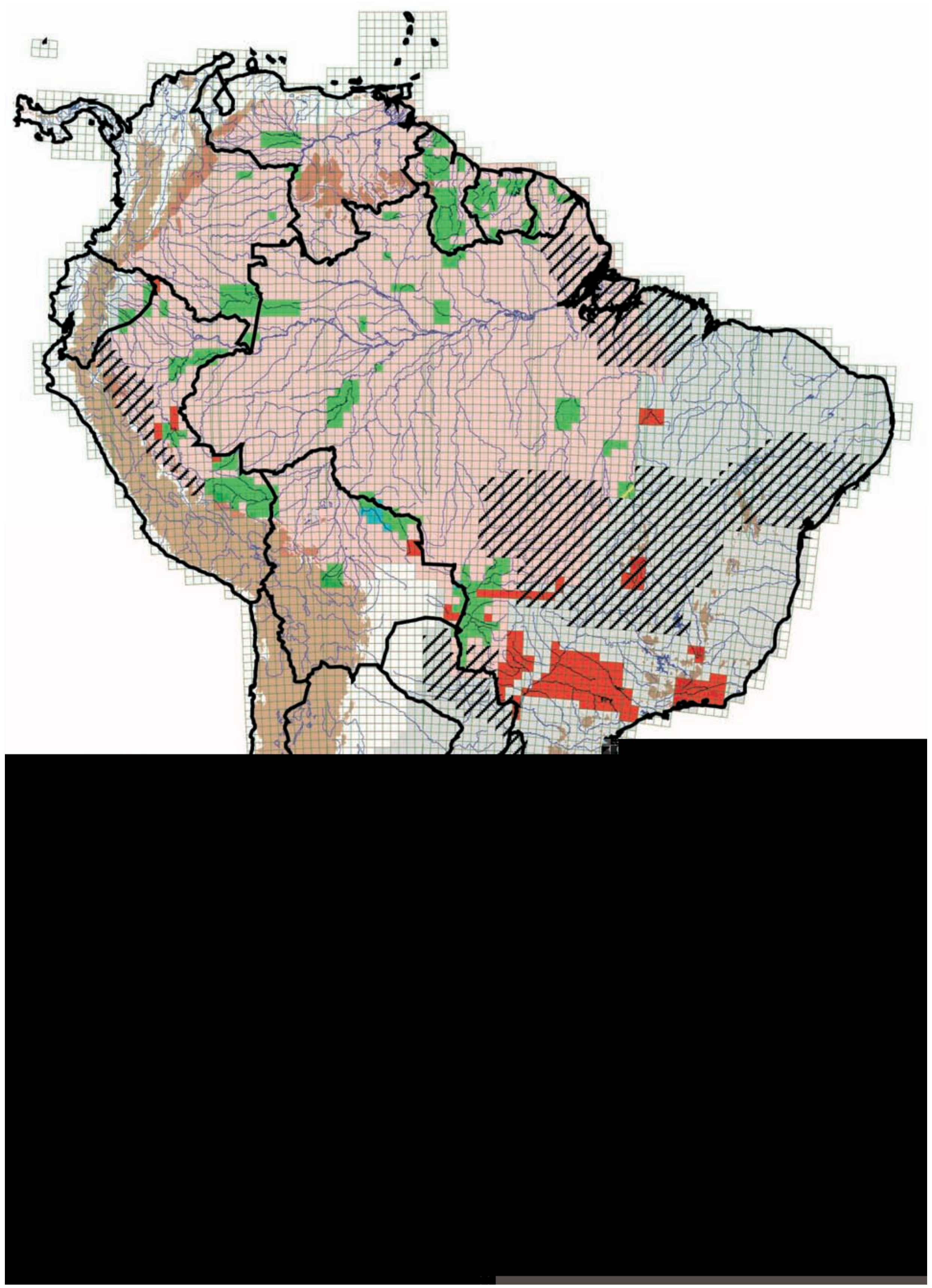

*Fig. 77: Priority border area grid squares for surveying within the current estimated distribution range of the species. **(ISOS).***

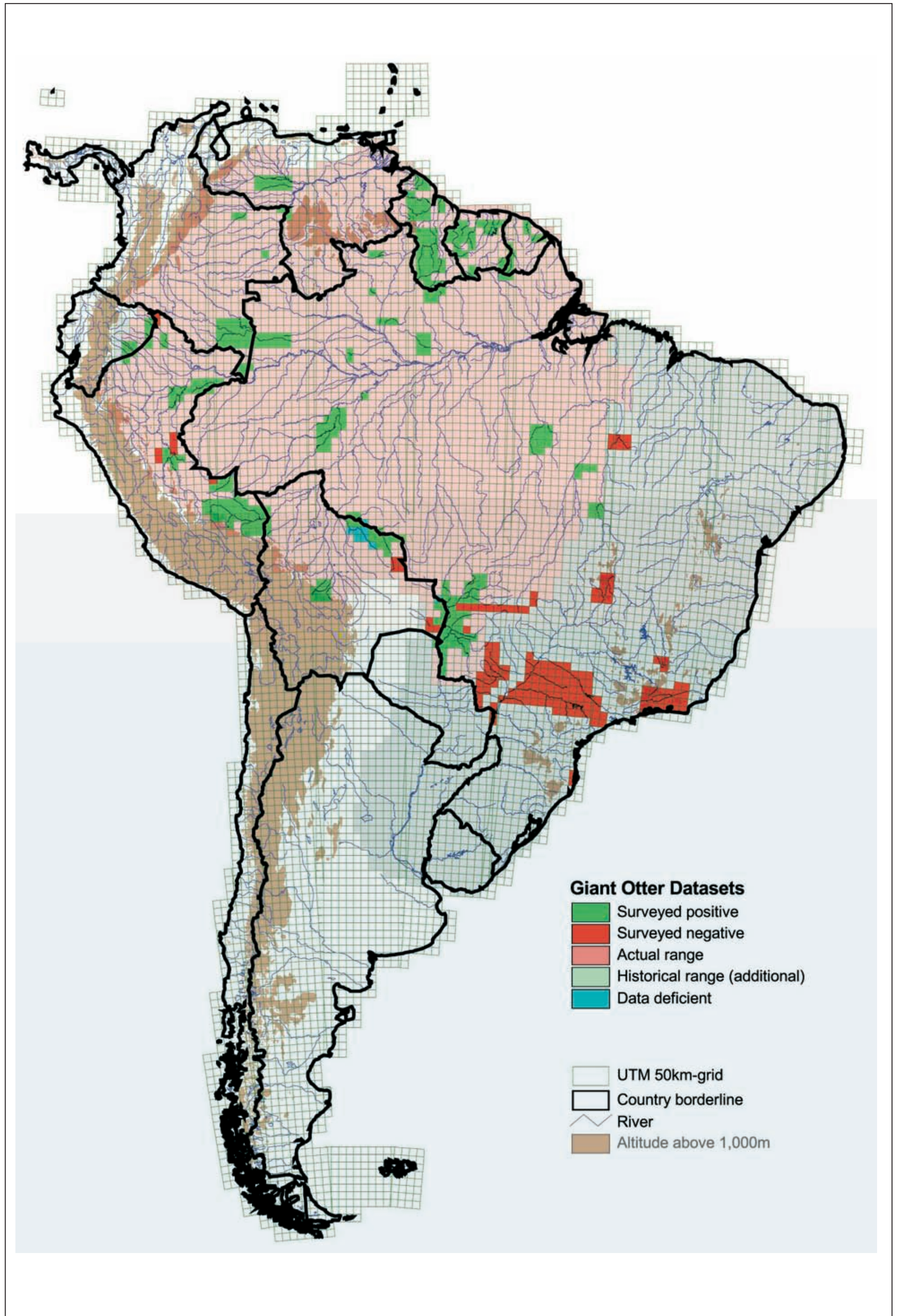

Fig. 78: The original distribution range of the giant otter.

not adequately appreciated or who want to publish their data first. This is no problem for ISOS since it offers the possibility to restrict the use of data. The intention of ISOS is not to make use of other people's efforts; its main intention is to ensure that all available distribution data for otters are secured for the long-term (in a comparable format).

Another obstacle is sometimes the policy to prevent the public from becoming aware of otters occurring in specific areas - for whatever reason. Because of its possibilities to restrict the use of data this is also no problem for ISOS. The messenger can decide, for example, that his or her data are free exclusively for scientific or internal governmental purposes. And, if the reasons for the restriction can be dropped after some years, the data are still available for everybody. In the reverse case, if data are withheld on a private basis and it is attempted to reproduce them after several years, this usually fails and does not deliver reliable data.

Generally, ISOS is able to store and process all kinds of data related to otter distribution (positive records resulting from occasional observations and systematic surveys, negative sites of systematic surveys, and records from questionnaires and publications). The great advantage, whether at the regional, national, or international level, is the standardised format for storing data and the flexible possibilities for making use of the data.

Thus far, ISOS is constructed for indirect data transfer only. This can be undertaken by print out of the survey and finding report (**Appendix 4**) which has been designed to facilitate the transfer of data to an input mask for the databank in Germany (by mail or fax). In the future, it is planned to develop an internet-based input mask which will allow transfer of data from survey and finding reports by the surveyors themselves.

The input mask consists of a table with columns which must be filled in as well as columns which are optional. Where codes are used these are explained directly at the column so that no handbook or code tables are needed. The input mask (and the survey and finding report) are sub-divided into the following sections:

A. Basic data
B. Description of survey site or place of finding
C. Details of survey method
D. Results/findings
E. Origin of data and whereabouts of documentary evidence
F. Results of additional examinations

Processing of data

For processing of ISOS data the common databank software MS ACCESS® (part of Microsoft Office® package) and the Geographic Information System software ArcView® (by ESRI) are used. Special programme tools allow, for example, the conversion of coordinates of the geographic location of survey sites between different coordinate systems (geographic grade coordinates - degrees or decimal, UTM, MGRS) and different geodetic datums, to ensure correct positioning of locations independent of basic coordinates or map projections.

Possibilities of data processing are highly variable. For objectives related to distribution, data can be prepared to show:

- distribution (positive and/or negative sites) referring to different grids,
- percentage of positive sites referring to squares of different sizes and to different grids,
- distribution referring to the whole of a continent, to countries, to the first administrative level of countries (federal states, departments, etc.), or to specified parts of (different) grids,
- distribution of specific detailed information (otters found dead (including cause of death), cubs, etc.),
- trends (distribution/population).

For objectives related to specific questions, data can be prepared to give, for example, information on:

- background of data (survey methods, etc.),
- number/relationships between kinds of proof,
- number/relationships to causes of death,
- age or size of animals (found dead or alive),
- number and whereabouts (addresses) of specific kinds of proof (carcasses, skins, skulls, etc.),
- results of specific examinations, or addresses where these results are available,
- addresses of surveyors, finders, or messengers,
- references for publications.

All this information can be related to different regions, but also to different periods.

Mapping of data

As described earlier, Aktion Fischotterschutz has developed a digitised world-wide grid for 50x50 km squares and 100x100 km squares based upon the UTM grid. This grid can be transferred to different map projections.

In addition to print outs, maps can be computed to files of the following formats:

- Placeable WMF
- Windows Metafile
- Windows Bitmap
- PostScript New (EPS)

register the whereabouts of this documentary evidence. This will enable scientists searching for tissues for specific analyses to know where to ask for this material.

- Obviously, ISOS cannot only present most of the above mentioned results as graphs but also provide statisti-

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4. Population Census Methodology Guidelines for the Giant Otter (PCMG-GO)

Introduction

Due to time and cost constraints, a population census is unlikely to be carried out on a national or range-wide level. It is more probable that a census is conducted, for example, as part of a study into giant otter demographics within a National Park or as part of a species conservation programme at the local or regional level.

To carry out a census or total count the following criteria must be approached as closely as possible (JARMAN et al. 1996):

1. The entire survey area, not just sample plots within it, must be searched.
2. All animals in the survey area must be detected and counted, and none must be counted twice. In other words, the observation probability should be equal to 1.
3. The census must be conducted over a short period so that no immigrations, emigrations, births, or deaths occur, and in a way that ensures no animal will evade the observer and leave the area before it is counted.

In the case of the giant otter, we are able to approximate these ideal criteria:

4. Most giant otter habitats can be accessed by boat (with the exception of some marsh habitats, rivers with many rapids or waterfalls, and very narrow creeks); therefore, entire survey areas can be covered.
5. The giant otter is a large, easily visible species that is exclusively diurnal. It lives in open, aquatic habitats, in social groups that are not too large to be accurately counted. Each individual is identifiable by its unique throat marking, making it possible to avoid double counting. Sign produced by giant otter groups is very characteristic, making it possible to identify areas of recent activity. This greatly facilitates group location.
6. Giant otter censuses are carried out over a period of several weeks, at the end of the dry season. As water levels are low and otters are restricted to permanent water bodies, movement out of the census area is minimized. At this time groups have young cubs, so additional births are unlikely.

Giant otter censuses rely on the observational technique of individual identification (RUDRAN et al 1996). Unlike other species, such as lions (SCHALLER 1972) and wild dogs (BERTRAM 1979, in WILSON et al. 1996), that require habituation for this technique to work, in areas of low human disturbance the characteristic behaviour of giant otters to investigate intruders ensures that the surveyor is usually not avoided, even by animals that are not habituated.

Due to its reliance on individual identification, a population census is not recommended in areas where giant otters have (had) negative experiences with humans (hunting, commercial fishing, etc). This is because in these areas giant otter groups do not display their characteristic investigative behaviour, instead hiding or fleeing when encountering humans. This makes successful filming of throat patterns, and therefore identification, virtually impossible.

Dispersing giant otters, known as transients, are shy and elusive (SCHENCK 1999) rarely investigating observers and/or periscoping. Further work is necessary to determine the observation probabilities for transients in different habitats, in order to ascertain to what extent they are underrepresented in census results.

Objectives of a population census

The primary objective of a population census is to encounter all giant otters within a defined survey area in order to determine population size. Secondary objectives include the collection of demographic and ecological information. Both can contribute to species and habitat management and conservation (SCHENCK et al. 2003) and become more valuable if the census is repeated at regular intervals as part of a long-term monitoring initiative.

Choice of census area

Depending on the objectives of the study, and the funds and manpower available, in general the census area should be of a size that it can be surveyed within a reasonable time period (e.g. a maximum of one or two months), especially if long-term monitoring is planned and an annual commitment of resources is required. It should be sufficiently large to produce representative and meaningful data in accordance with the objectives of the census. For example, if we are interested in data of three giant otter families inhabiting a group of oxbow lakes, the census area should cover these lakes and any associated water bodies (creeks, swamps, etc). If we are interested in data regarding the giant otter population of a National Park all water bodies representing potential habitat in the Park should be investigated. In this sense, accessibility is another important factor which will determine choice of census area. Ideally, it should not be so remote that it takes many days just to get there. However, the facts that a large part of the giant otter's range *is* very remote, and that many of the remaining giant otter strongholds are in pristine areas (SCHENCK 1999) mean that this may be unavoidable. Areas that have a significant percentage of 'difficult' terrain (e.g. *Mauritia* palm swamps) which cannot be surveyed easily, or where giant otters cannot easily be observed, should be avoided in order not to violate the census criteria mentioned above.

Knowledge of the home ranges of resident giant otter groups and experience of field conditions will increase with every census. This will help to reduce the length of the census period required in areas where long term monitoring is carried out.

Seasonal timing

A population census should be conducted once the cubs of that year are routinely participating in group activities; in many habitats this is during the end of the dry season (SCHENCK 1999, GROENENDIJK et al 2001). Conditions during the rainy season are such that finding dens and campsites becomes difficult or virtually impossible and estimating when they were last used unreliable. Giant otters tend to disperse into inaccessible parts of their territories at this time of year. At the end of the dry season is also when cubs are less vulnerable to disturbance and are old enough to periscope, so that their neck markings can be filmed. In areas where cubs are born at the end of the dry season, for example, in the central Brazilian Amazon (ROSAS pers. comm.), then it may be necessary to delay the census until the cubs are a few months older.

For a more complete overview of the movements of solitary individuals, cub survivorship and changes in group structure, an additional census can be carried out at the end of the wet season. For long-term monitoring, censuses should be repeated at least once a year, at the same water level and over the same time period using the same methodology.

Use of maps and satellite images

To successfully plan and carry out a survey it is essential to have good quality, printed or digital topographic maps (RUDRAN and FOSTER 1996). These should be at a scale no larger than 1:250,000, preferably 1:100,000 or lower. They are used to plan the census itinerary and, together with a compass and/or GPS in the field, to locate isolated water bodies such as oxbow lakes and swamps. The total census area should be calculated as it will be necessary to calculate densities. All water bodies in the census area (rivers, streams, lakes, etc.) that are deemed to be suitable habitat for the species are investigated. Census planning and execution can be optimized with recent satellite images for the area, as many habitats where the giant otter is found are highly dynamic and South American topographic maps are often not updated regularly. This means, for example, that oxbow lakes and swamps that are marked on a topographic map may have long dried out and checking them is a waste of time and effort, or that new oxbow lakes or river channels that have been formed may be missed.

Identifying and ageing giant otter campsites and dens

Dens and campsites are recorded and aged during a census, not as a means for estimating abundance or an abundance index, but because they provide a tool by which we can maximise our chances of encountering giant otter groups (refer to **Chapter 2** for identification and ageing techniques). A water body is investigated repeatedly during a single population census if sign is encountered which cannot likely be attributed to one of the already identified giant otter groups.

Counting individuals and recording throat patterns

The first step when observing giant otters is to count them. This takes precedence over filming throat markings. The important point here is to count the otters with as great a certainty as possible. Once the otters have been counted, the next step is to film the throat pattern of each animal, since this is the most accurate means of identification and prevents double-counting of individuals (refer to **Chapter 2** for techniques). Obtaining a minimum of 60% of throat markings within a group is recommended in order to positively identify a group.

Determining age classes of individuals

In order to determine population size all we are interested in is otter numbers. However, as population censuses are, and probably will continue to be, often associated with studies of demographics or population dynamics, surveyors are also interested in determining age classes of individuals.

In order to ensure consistency in census findings we propose the following protocol for giant otter age classes. It is based on a standardisation of existing interpretations in the literature and the workshop discussions related to the development of this document. Giant otters are:

- *cubs* up to 6 months old,
- *juveniles* between 6 months and 1 year of age,
- *sub-adults* or *yearlings* between 1 and 2 years old, and
- *adults* after 2 years of age.

A cub is a young animal that still nurses. Field observations and captive data show that giant otters are weaned at roughly 6 months of age (LAIDLER 1984, Sykes-Gatz pers. comm.). Juveniles are young animals up to 1 year of age that no longer nurse but that rely to a great extent on other group members for sustenance. Sub adults are individuals that may be equal in size to adults (though they rarely match their bulk) but that have not yet reached sexual maturity. Although this will vary on an individual basis, information from captive otters suggests that giant otters, of both sexes, reach sexual maturity at roughly 2 years of age (HAGENBECK and WÜNNEMANN 1992). At sexual maturity an animal becomes an adult. There may be several adults within a giant otter group in addition to the reproductive pair.

In a single population census, only the number of cubs within the group should be determined, since these are recognizable by their size and behaviour (see Figures 80 to 82), whereas juveniles, sub adults and adults are difficult to distinguish from each other. The number of sub adults and adults per group will be determined with subsequent censuses, as the older animals in the group disperse or die, and the cubs identified in previous censuses mature. The size of an individual should only be visually compared with members of the same group (and preferably on land where the entire body is exposed); not mentally compared with previous sightings.

The following observations are useful for differentiating cubs from other age classes in a group:

At the age of 3 months, when cubs begin to swim routinely with the rest of the group (before then surveyors cannot fail to identify them as cubs, although they spend the majority of their time in the den), they are sometimes confused with older members because at a quick glance their heads seem not much smaller. However, on closer inspection, their heads are in fact roughly half the size of a fully grown individual, they are positioned low in the water, and their movements tend to be uncoordinated.

As weeks pass, the swimming motion of cubs becomes smoother, but they continue to hold their heads just above water level. They are unable to periscope (so filming of cub neck markings while swimming is not possible), and are almost entirely unaware of potential danger, instead concentrating fully on keeping up with the group and on begging for fish. They are very vocal, constantly emitting high-pitched or insistent tones, seeking reassurance or demanding to be fed. They begin to learn to periscope at about 4 months of age, and at 5 or 6 months periscope and snort often, though briefly, at anything that catches them by surprise (a leaf, a bird etc.). They may also not be able to identify the source of group alarm and so periscope at the wrong object.

From 6 to 9 months, the head of a juvenile is roughly three quarters that of an adult, and its body (total length) is roughly half to three-quarters that of an adult and considerably less bulky. Its neck is noticeably thinner. Juveniles beg loudly and frequently, and periscope rather vigorously at real sources of alarm. After 9 months, it is difficult to distinguish any difference in head size in swimming otters. At 1 year old, the now sub adult is almost fully grown but still lacks bulk. At this stage, it is very difficult to distinguish a sub adult from the adults in a group, so ***no attempt should be made to identify or count the number of sub adults, unless the birth dates of the individual otters are known.*** Sub adults still beg (from adults and from each other) but less often, and may also steal fish from one another. Sub adults and adults have been seen snatching fish from cubs, as well as bringing fish to cubs (STAIB 2002). Reproductive females have been observed begging fish from the reproductive male. In conclusion, although certain behaviours may be exhibited more often by certain age classes, begging, snatching of fish from other individuals, and providing fish to other individuals are not unequivocal determinants of age class.

Additionally, although it is frequently one of the reproductive pair that approaches an intruder first, this is not a general rule and should not be assumed to be always the case; a curious sub adult or another adult may be the quickest to respond (STAIB 2002).

Animals that leave the family group, referred to as transients, are believed to have attained sexual maturity and are therefore adults. However, some individuals stay with the group for anything up to 5 years before dispersing or they may never leave, instead taking over one of the reproductive roles (GROENENDIJK et al 2001, STAIB 2002). Therefore, becoming a transient cannot be used as a criterion for defining the age of an individual.

Definite conclusions regarding group size or number of cubs can rarely be drawn based on a single encounter; it is important to keep an open mind with respect to the significance of observations, especially resulting from a single population census. For instance, the sighting of a single animal does not necessarily mean that it is a transient; it may be a member of a group temporarily travelling alone. Likewise, two otters seen together may be:

- a mated pair,
- a pair of same- or opposite-sex transients, or
- members of a family group.

Only by having repeated observations over several days in the same area with the same group can greater certainty be attributed to findings.

Sexing individuals

Sexing is only possible when individuals are entirely out of the water, usually when basking or grooming on logs (see Figures 83 to 85). It is sometimes possible to film giant otters as they emerge from the den first thing in the morning or as they enter at dusk. These are excellent opportunities to film throat markings and to establish the sex of individuals. However, it carries a high risk of disturbance and should never be carried out during the beginning of the dry season when any cubs are very young and especially vulnerable. Sexing of a female which has not suckled young is difficult in the field as the four teats are tiny. A mother, on the other hand, will have greatly elongated teats which retain their length subsequently to some extent. The male's scrotum does not become clearly evident until he is at least one year old (STAIB 2002). ***Body size is not an indication of gender or of hierarchical status*;** males are sometimes considerably smaller than females, and vice versa, and the breeding pair are not necessarily the largest animals in the group (SCHENCK 1999, GROENENDIJK et al 2001, STAIB 2002).

Data recording and storage

We recommend that all data collected in the census is recorded in a survey and finding report, based on the survey and finding report in **Appendix 4.** Individual surveyors can add data requirements to this survey and finding report as required, but should not delete or change any of the existing fields.

Data recording and storage should follow the grid type, coordinate system, grid size and geodetic datum recommendations developed and agreed for the RDSS-GO (see **Chapter 3**, pages 46-50). The most important difference is that in a census we do not have a defined survey site of specific size; all potential habitat within the census area is investigated. The census area may cover part of a sub-quadrant, a complete sub-quadrant or many sub-quadrants. ***A separate survey and finding report must be completed for each sub-quadrant partially or completely investigated. Only those signs and sightings that are geographically located within the sub-quadrant in question are entered in each form.***

Upon completion of the census, a copy of the survey and finding report should be sent to Aktion Fischotterschutz, Germany, for centralized storage in the International System for Otter Surveys (ISOS) database (see **Chapter 3**, pages 56-59), as well as any other cooperating institution that can use the data for conservation purposes. Not all data collected in the report can currently be stored in ISOS. The survey and finding report and the data storage procedures will be refined as experience is gained with the implementation of this methodology.

Sighting catalogues

Developing a sighting/throat marking catalogue is important, especially if it is planned to carry out repeated censuses in the surveyed area to investigate population demographics (SCHENCK 1999). The sighting catalogue is normally based on the different giant otter family groups encountered during the census. For every animal encountered, we record (ideally) its throat marking, identification number or name, gender, sighting location and date. There should also be a section of additional comments, which can include whether the individual is a cub or a transient or whether it is one of the reproductive pair, any other distinguishing features and a reference to the video or photographic evidence of the sighting to facilitate future revision of material.

The following are useful guidelines when drawing markings:

- Fill-in head and throat outlines should be used; this helps to standardize the proportions of the marking.
- Scars, white lips, missing ears, missing teeth, etc. can also be noted
- Neck markings should not be drawn from memory or during direct observation. Drawings can be made from photographs, slides or 'frozen' images on a computer or television screen. Several images of the same animal (i.e. different angles, different positions of the animal) will result in a higher quality throat marking for future identification. A transparent sheet can also be used to trace the screen image directly; the latter can then be scanned using Photoshop.

If computer manipulation is desired, photographs and slides can be scanned. Some experience is required for dealing with digital pictures on a computer. For in-

Fig. 80: Cub displaying begging behaviour (Photo: F. Hajek).

Fig. 82: Resting on logs is ideal for sexing. Note the elongated teats of the reproductive female on the right (Photo: F. Hajek).

Fig. 84: Adult male, scrotum just visible (Photo: N. Duplaix).

Fig. 85: Adult male basking on a log (Photo: F. Hajek).

stance, when re-sizing an image, never do so from the sides or from the bottom, *always* from the corners, otherwise the throat marking is distorted.

Some researchers prefer to give identified otters a name and others a number. The former is useful in the sense that animals can be named after a distinguishing feature (i.e. a characteristic shape in the throat marking, dark shading around the eyes, etc) which then aids future recognition. Alpha numeric identification is useful in the sense that more information can be conveyed. For example PATU22-01M, could represent an otter from the PATUyacu river, first sighted at location 22. It is the first (01) animal of the group to be identified and it is a male (M). Whatever the method, the important point is that every individual is given a unique name or number.

Figures 86 to 88 show three different sighting catalogues from three different projects that are currently looking into long term giant otter group composition.

Interpretation of data

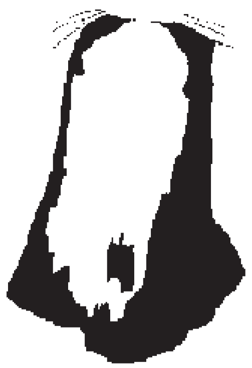
The sum of all the individuals encountered during the census is the absolute abundance of giant otters for the area. With this value for absolute abundance we can calculate crude density. Crude density is defined as the number of individuals of a species per unit area

of the entire study site (RUDRAN et al. 1996). Therefore, crude density is the total number of giant otters encountered divided by the total census area (including land areas not utilized by the giant otter), as determined from the topographic maps used, and should be expressed as individuals per square kilometre (ind/km^2).

It is tempting to also calculate ecological density, defined as the number of individuals of a species per unit area of the habitat that is utilized by the species (RUDRAN et al 1996). Therefore, for the calculation of ecological density a detailed knowledge of the home ranges of the different giant otter groups is required. Determining home ranges, and hence ecological density, is outside the scope of this census methodology.

Since the occurrence of giant otters in their natural habitat is characterised by low densities over large areas and high local densities in their preferred habitats (SCHENCK and STAIB 1998) as a rule crude density will be much lower than ecological density.

GRUPPO M - IGARAPE XIXUAU



EME, female, primo avvistamento Ottobre 2000

Ottobre 2000, Igarape Xixuau, in coppia con M
Dicembre 2000, Igarape Xixuau, in coppia con M, trasporta un cucciolo
Ottobre 2001, Igarape Xixuau, in coppia con K, M scomparso, cucciolo presente
Novembre 2002, Parana Maloca, nati due cuccioli, Dago e K presenti
Novembre 2003, Parana da Bianca, 2 subadulti e K presenti

DAGO, male, primo avvistamento Dicembre 2000

Dicembre 2000, Igarape Xixuau, trasportato da Eme, poche settimane di vita
Ottobre 2001, Igarape Xixuau, con Eme e K
Novembre 2002, Parana Maloca, accompagna il gruppo con i 2 cuccioli,
in due occasioni visto dormire in tana separata
Agosto 2003, Parana da Bianca, accompagna il gruppo
Novembre 2003, ha abbandonato il gruppo

ZOE, primo avvistamento Dicembre 2002

Dicembre 2002, Parana Maloca eta' stimata 3 mesi circa
Febbraio 2003, Parana Maloca, primo successo di pesca documentato
Novembre 2003, Parana da Bianca

JUAN, primo avvistamento Dicembre 2002

Dicembre 2002, Parana Maloca eta' stimata 3 mesi circa
Febbraio 2003, Parana Maloca,
Novembre 2003, Parana da Bianca

Figure 86. Example of a giant otter catalogue, Giant Otter Amazon Project, Xixuau Reserve, Brazil (EVANGELISTA unpubl. data).

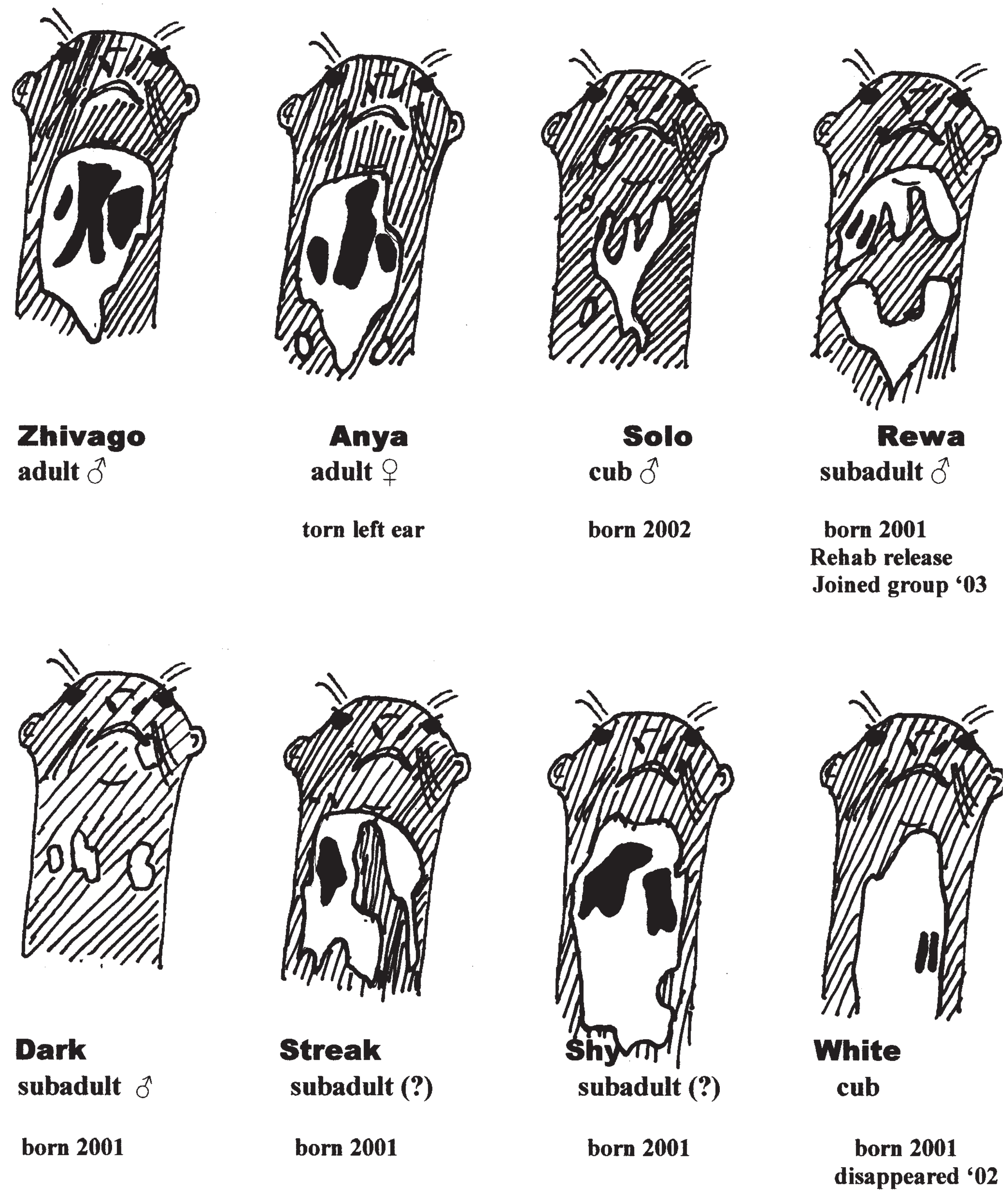


Figure 88. Example of a giant otter catalogue, Upper Rupununi River, Guyana (DUPLAIX 2003).

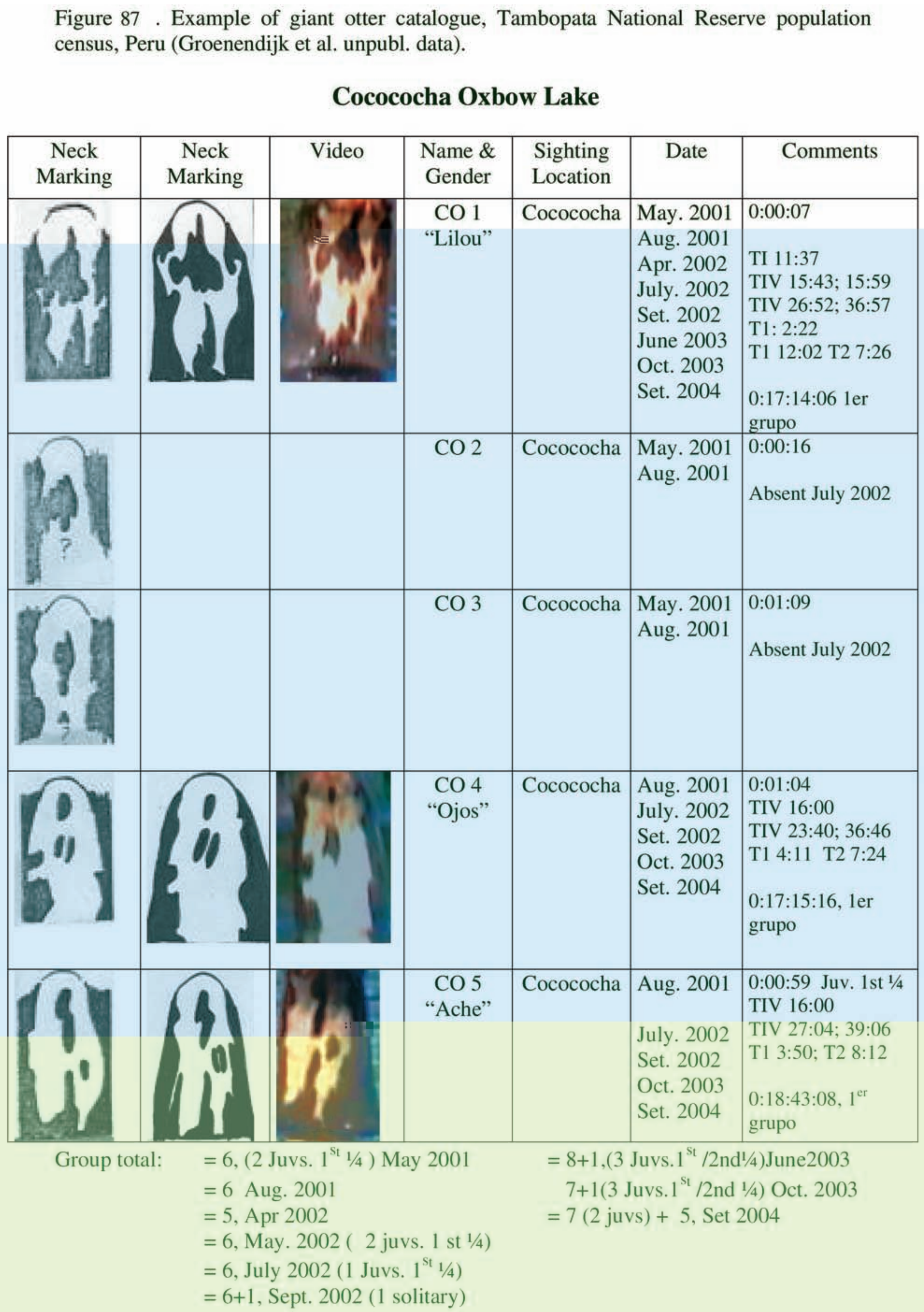


Figure 87 . Example of giant otter catalogue, Tambopata National Reserve population census, Peru (Groenendijk et al. unpubl. data).

Cocococha Oxbow Lake

Neck Marking	Neck Marking	Video	Name & Gender	Sighting Location	Date	Comments
			CO 1 "Lilou"	Cocococha	May. 2001 Aug. 2001 Apr. 2002 July. 2002 Set. 2002 June 2003 Oct. 2003 Set. 2004	0:00:07 TI 11:37 TIV 15:43; 15:59 TIV 26:52; 36:57 T1: 2:22 T1 12:02 T2 7:26 0:17:14:06 1er grupo
			CO 2	Cocococha	May. 2001 Aug. 2001	0:00:16 Absent July 2002
			CO 3	Cocococha	May. 2001 Aug. 2001	0:01:09 Absent July 2002
			CO 4 "Ojos"	Cocococha	Aug. 2001 July. 2002 Set. 2002 Oct. 2003 Set. 2004	0:01:04 TIV 16:00 TIV 23:40; 36:46 T1 4:11 T2 7:24 0:17:15:16, 1er grupo
			CO 5 "Ache"	Cocococha	Aug. 2001 July. 2002 Set. 2002 Oct. 2003 Set. 2004	0:00:59 Juv. 1st ¼ TIV 16:00 TIV 27:04; 39:06 T1 3:50; T2 8:12 0:18:43:08, 1er grupo

Group total: = 6, (2 Juvs. 1St ¼) May 2001
= 6 Aug. 2001
= 5, Apr 2002
= 6, May. 2002 (2 juvs. 1 st ¼)
= 6, July 2002 (1 Juvs. 1St ¼)
= 6+1, Sept. 2002 (1 solitary)
= 8+1,(3 Juvs.1St /2nd¼)June2003
7+1(3 Juvs.1St /2nd ¼) Oct. 2003
= 7 (2 juvs) + 5, Set 2004

Figure 87. Example of a giant otter catalogue, Tambopata National Reserve population census, Peru (GROENENDIJK et al. unpubl. data).

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5. Ideas and Suggestions for Further Research

This chapter is intended to guide surveyors as to which research issues could be addressed during future surveys. There are two main levels for further research associated with the standardisation of giant otter survey methods: studies to evaluate the methods, aimed at increasing the effectiveness and optimising the organisation of future surveys, and studies to increase knowledge of the biology, ecology and conservation of the giant otter, aimed at providing data to advance the conservation of the species.

5.1 Evaluation of the Survey Methodology Standards and Guidelines

Many aspects of the different methodologies (distribution survey and population census) are based upon experiences of a limited regional or temporal background. Expansion of this data base can increase reliability of results or support the optimisation of the methods. Many features of the methodologies need (further) examination and field testing. Below are listed a few of the main issues:

5.1.1 Standard field survey techniques

- Appropriateness of cylindrical scats and scratch walls as additional signs indicating giant otter presence.
- Field testing, particularly by new surveyors, of the keys to identify and age giant otter campsites and dens (and of the use of primary and secondary appearance/age characteristics).
- Field testing of the Survey and Finding Report.

5.1.2 Standard distribution survey method

- Appropriateness of the selected geographic degree coordinate system.
- Appropriateness of selecting the survey site according to the highest likelihood of encountering giant otters.
- How does surveyor experience influence the results?
- Field testing of the giant otter survey questionnaire.
- Handling of the irregular-shaped units in the border areas of UTM zones.
- Is the standard survey distance of 20km unnecessarily long? Is a stop-at-first-sign approach sufficient? This should be tested in different habitats with different giant otter densities.

5.1.3 Range-wide distribution survey strategy

- Appropriateness of using a 100x100km UTM grid as the standard for the range-wide distribution survey, with one 25x25km sub-quadrant and one site per sub-quadrant being surveyed; will the resulting giant otter distribution be overly optimistic? So much so that it may lead to equivocal conservation and policy decisions?
- Is the proposed periodicity of range-wide surveys – initiated every 7 years and completed within 5 years – realistic?
- Can giant otter dispersal distances and/or territory sizes be used as a basis for determining an appropriate grid size for surveys?

5.1.4 Population census

- Do giant otter population censuses, as described, adequately meet the criteria for a true census?
- What should be the standard for expressing giant otter ecological density (per km of river, per km of bank, per surface area of water, per volume of water)?

5.1.5 Measuring relative abundance

- Is it possible/realistic to establish a standard measure of relative abundance that is sufficiently accurate to make spatial and/or temporal comparisons?
- How can we measure the observation probability of otters in different habitats?
- Can distance and (visual) capture-recapture methods be used to estimate giant otter population size?
- Can indirect signs (dens and campsites) be used for quantitative affirmations on population abundance or population status? What are the environmental conditions that influence the number of signs produced by giant otter groups/individuals?

5.2 Biology, Ecology and Conservation of the Giant Otter

The logistical and manpower expense/effort involved with standardised monitoring of the distribution and abundance of giant otters could be utilised for purposes other than to document distribution and population trends of the species. Since numerous questions regarding the biology and ecology of the giant otter remain unanswered, surveys can also support the increase of knowledge, which in turn will hopefully contribute towards the conservation of this species. Carrying out these dual or multipurpose field trips may facilitate the obtaining of funds for surveys, or be part of a strategy in which the survey is integrated into a wider conservation project or initiative. Careful planning and execution are essential, however, so that these additional research or conservation activities do not confuse or interfere with the survey activities themselves (see chapter 1).

5.2.1 Studies into differences in habitat and how habitat types may affect the otters' use of that habitat

- Comparison of giant otter abundance and carrying capacity in white water, black water and clear water floodplains.
- Campsite frequency versus substrate: Are campsites more frequent on sand? On earth? On rock? On grass? On leaf-covered clearings?

5.2.2 Better understanding of group composition and group dynamics

- It has been observed that family groups may split and re-unite while the cubs are being raised. Sub-adults may wander off as a subgroup for weeks on end, eventually rejoining their parents. How common is this behaviour?
- Transient behaviour: Are departures preceded by fights with the adults? What are the dispersal patterns and distances travelled? How do transients find a partner? What is their marking strategy? How common are (casual) group associations between non-related individuals?
- Is the rule of one reproductive pair per group applicable across the species range?

5.2.3 Effect of disturbance on otters and their prey

- In gold mining areas, once clear waters become turbid and muddy, how does this affect local fish populations? Does turbidity affect fish size? Do gold mining and increased water turbidity have an impact on local and commercial fishing?
- What is the relation between turbidity and catch success? Is the success catch rate of otters the same in turbid as in clear waters?
- Do giant otters accumulate lethal concentrations of mercury? What is the impact of mercury accumulation on otter survival success?

5.2.4 Research on population genetics

- Can non-invasive methods be used for the study of giant otter population genetics?
- Do Amazonian and Pantanal giant otter populations interchange?
- What is the minimum viable population size for giant otters?

5.2.5 Studies into the interaction between fishermen and giant otters

- Is it realistic and useful to standardise methods for giant otter diet analysis? Do bones and scales in giant otter scats really reflect consumption? What is the effect of digestion on bones and scales?
- What are the factors that determine daily fish consumption by giant otters? How important are discards?
- Which factors determine fish species selectivity and fish size selectivity by giant otters?
- Do subsistence/commercial fishermen and giant otters compete with each other? In which type of habitats is competition between fishermen and giant otters thought to be highest?
- What percentage of local fish stocks is consumed by, respectively, fishermen and giant otters?

5.2.6 The giant otter as a keystone species

- Which ecological role does the giant otter play in aquatic habitats?
- How do limnological characteristics of lakes or rivers change in response to the presence or absence of giant otters?
- What is the effect of giant otters on fish population density and on fish community structure?

5.2.7 The giant otter as an umbrella/flagship species

- How effective is the giant otter as a tool or ambassador for aquatic habitat conservation?
- What advocacy methods can we use for giant otter conservation?
- How can we minimise the threats and maximise the benefits arising from nature tourism directed at the species?

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Appendix 1

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Signs and Sightings of the Neotropical Otter (*Lontra longicaudis*)

Introduction

In many regions, the giant otter shares its habitat with the Neotropical otter *(Lontra longicaudis)*, and their respective signs, particularly the dens, may be confused. One otter species sometimes closely investigates sites of the other, and Neotropical otters may even defecate near the entrance of, or take-over a giant otter den, so great care must be taken when identifying sign. It is therefore important for prospective surveyors to be initially accompanied in the field by somebody who has experience with both otter species.

Just as the distribution and conservation status of the giant otter is little known in many regions, even countries throughout its range, so the distribution and conservation status of the Neotropical otter has been neglected. Surveyors should also determine the presence of this smaller otter species; methodology standardisation is underway, led by Helen Waldemarin.

Scats

Neotropical otters deposit cylinder-shaped scats ranging in length up to 12cm, and in width between 0.8 to 2.5cm. They are never trampled (unlike the giant otter's) and are usually deposited in conspicuous locations (e.g. partially submerged logs, rocks and/or beaches) but also on banks, never on campsites (see Figures 89 to 93). Scats are often associated with scratch walls, dens and resting sites. The scat is generally smaller, and with a more defined shape than that of the giant otter. Neotropical otters eat smaller fish than giant otters do, as well as crustaceans, and chew them more thoroughly – the scat is firmer with smaller hard part fragments than giant otter scat. Neotropical otter scat and urine also smell differently to those of the giant otter, but it requires some field experience to be able to tell them apart reliably. Scats can be deposited separately or in sites where it is possible to find several together. However, it is not common to find piles of scats (as in the case of the Eurasian otter (*Lutra lutra*)).

Scent deposits

A scent deposit is a mucous substance, excreted by the anal gland (see Figure 94). It does not include diet remnants and has a very strong smell. It is usually deposited in conspicuous places as well as amongst scats. On beaches, scent, scat and/or urine are sometimes deposited in or near a small mound, known as a 'sand castle', scratched together (see Figures 95 and 96).

Dens

Neotropical otter dens are very similar to giant otter dens in appearance and can only be differentiated with certainty when scat and tracks are obvious. They are often located under root systems and between rocks or under overhangs (see Figures 97 to 99). Sometimes it is possible to find scratch marks on the walls inside the single entrance which is usually under 18cm in diameter, and 15 to 18cm high. The entrance may be under water, at the water's edge or in a rock/boulder pile.

In areas were Neotropical otters and giant otters are sympatric, the former may use old giant otter dens (in which case the Neotropical otter den may have several entrances and air holes in addition to typical Neotropical otter signs such as a sand castle). The size alone of a den entrance is therefore not a reliable indication of which otter species is using it, unless it is much smaller than a giant otter den entrance which has an average width of between 40 and 60cm (see Table 5).

Scratch walls

Scratch walls are vertical areas located in steep banks (see Figures 100 and 101). They can be associated with resting and scat sites, but it is also possible to find only the scratch marks. In Neotropical otter scratch walls, the space between nail marks is smaller than in those of the giant otter, but this difference can be identified only by experienced surveyors.

Tracks

Neotropical otter tracks are considerably smaller than those of the giant otter. Pointed nail depressions are often distinctly visible, whereas giant otters tend to have blunter nails. Measurements of tracks taken in Manu National Park and the Palma Real River (Peru), Rio de Janeiro Zoo (Brazil), the Rio Negro (Brazilian Pantanal),

Fig. 89: Neotropical otter scats on a sandy area, Coppename River, Surinam (Photo: N. Duplaix).

Fig. 90: Scats on a log, Manu National Park, Peru (Photo: C. Reuther).

Fig. 91: Scats on a log, Cuyabeno Faunistic Reserve, Ecuador (Photo: V. Cano).

Fig. 92: Neotropical otter sprainting on a fallen tree, Río Negro, Pantanal, Brazil (Photo: C. Reuther).

Fig. 93: Neotropical otter scats, Coppename River, Suriname (Photo: N. Duplaix).

Fig. 94: Recent scent deposit on a log, Cuyabeno Faunistic Reserve, Ecuador (Photo: V. Cano).

Fig. 95: Sand castle with a scat, Palma Real River, Tambopata National Reserve, Peru (Photo: F. Hajek).

Fig. 96: Sand castle with urine, Coppename River, Surinam (Photo: N. Duplaix).

Fig. 97: Neotropical otter den with an insect-covered scat at the entrance, Palma Real River (Photo: F. Hajek).

Fig. 98: Neotropical otter den under a rock shelf, Río Negro, Pantanal, Brazil (Photo: H. Waldemarin).

Fig. 99: Neotropical otter den in rocks, note the sand castle at the entrance, Coppename River, Surinam (Photo: N. Duplaix).

Fig. 100: Neotropical otter scratch wall, Río Negro, Pantanal, Brazil (Photo: H. Waldemarin).

Fig. 101: Neotropical otter scratch wall, Río Negro, Pantanal, Brazil (Photo: C. Reuther).

and the Mambucaba River (Brazil) show that the hind foot measures an average 5.8cm in width by 7.2cm in length while the forefoot averages 5.8cm in width and 6.1cm in length (REUTHER unpubl. data, HAJEK pers. comm.). The webbing of the feet is generally not visible (see Figures 102 to 107).

In Table 5, the measurements of den entrances, scats and footprints are compared. These are general guidelines; as explained previously, Neotropical otters will sometimes use giant otter dens and there may be some overlap in scat size when Neotropical otters eat only crab.

Fig. 102: Neotropical otter forefoot track (on left), Rio Negro, Pantanal, Brazil (Photo: C. Reuther).

Fig. 104: Neotropical otter hind foot track, Rio Negro, Pantanal, Brazil (Photo: C. Reuther).

Resting sites

Resting sites are generally used during the day. There are two types: one on the bank in the open and the other dug into the bank, creating a ledge. In the first, a slightly depression is visible, called a 'bed'. There are usually scratch marks nearby as well as a site where scats may accumulate. The excavated resting site is at first glance similar to a den, but is shallower. Scratch marks are commonly seen inside this type of resting site, and scats and tracks of the species are usually found in the vicinity. Neotropical otters will also rest on tree trunks and branches above the water, not always on or in banks.

Fig. 103: Neotropical otter forefoot tracks, Coppename River, Surinam (Photo: N. Duplaix).

Fig. 105: Neotropical otter hind foot track, Rio Negro, Pantanal, Brazil (Photo: H. Waldemarin).

Other (semi) aquatic mammals

If time is available, notes on the presence / absence of other endangered aquatic mammals such as manatees and dolphins, may be valuable to other researchers (see below). However, the recording of other (aquatic) mammal species observations may significantly increase the time spent on an otter survey. It is suggested that separate data collection sheets are developed in consultation with the relevant aquatic mammal experts (those who also have experience with giant otter surveys are listed below).

Fernando Rosas – manatees / dolphins / Neotropical otters
Miriam Marmonte – manatees / dolphins
Helen Waldemarin – Neotropical otters
Nicole Duplaix – Neotropical otters
Victor Utreras – dolphins

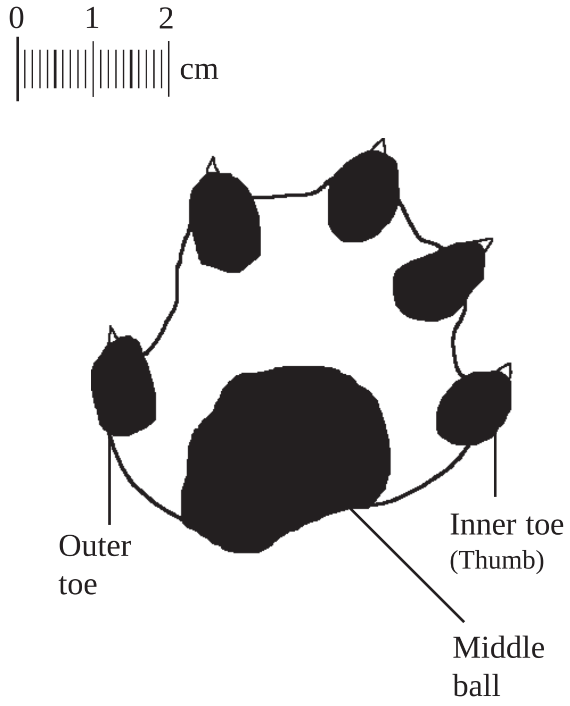


Fig. 106: Neotropical otter left forefoot, life-sized (Drawing: C. Reuther).

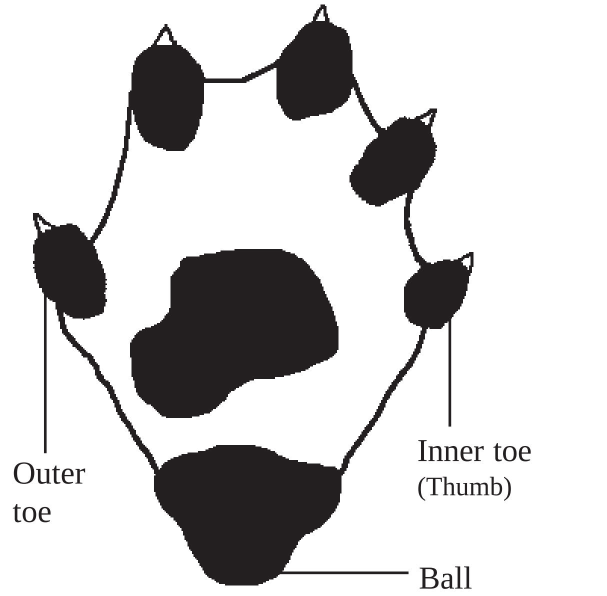


Fig. 107: Neotropical otter left hind foot, life-sized (Drawing: C. Reuther).

Appendix 2

Content for Laminated ‘Field Tips and Techniques for Giant Otter Surveys’

The following are important points to remember when carrying out a survey. Issues concerned with the planning of surveys (e.g. grid size, selection of survey site) are not included. It is suggested that copies of these sheets, as well as of the Giant Otter Survey and Finding Report (see Appendix 4) be laminated for field use.

Glossary

Sign
- These are indicative of giant otter presence.
- Refers only to giant otter tracks (footprints), campsites and dens.
- Latrines, cylindrical scats, and scratch walls are not considered as separate standard signs.

Campsite
- A patch of cleared land on the banks of water bodies which is used regularly for defecating, scent marking, drying out, grooming and resting.
- It must have at least one latrine.
- Sometimes a campsite consists only of the latrine.

Latrine
- Small areas characterised by the presence of giant otter scats and/or their remains.
- Every campsite has at least one latrine, sometimes several.
- Dens may also have latrines near the entrance.
- Latrines do not classify as a separate sign.
- If a latrine is found that is not associated with a den, then it is recorded as a campsite.

Recently in use
- A broadly descriptive term for a site where signs indicate giant otters are or were recently in the area.
- ‘Recently’ is defined as meaning up to an estimated two weeks prior to the surveyor’s visit.

Not recently in use
- A broadly descriptive term for a site where signs indicate giant otters have not recently been in the area.
- ‘Not recently’ is defined as meaning an estimated two weeks ago or more).

Survey Types and Requirements

Distribution survey
- The determination of the spatial occurrence of the giant otter within a given area, expressed in terms of presence or absence.
- Focuses primarily on signs as clear indicators of giant otter presence.
- Counting, identifying, sexing and ageing giant otters are not the priority in a distribution survey.
- Correctly identifying a giant otter den or campsite is all that is required; estimating whether it was used recently or not is not necessary.
- It is recommended to conduct the distribution survey in the period of intermediate water levels (at the end of the wet season / beginning of the dry season).

Population census
- A complete count of individuals within a given area, based on direct sightings and identification, in order to obtain an absolute population size for that area.
- During a population census, dens and campsites are recorded as being either ’recently in use’ or ‘not recently in use’.
- Correctly identifying a campsite or den as ‘recently in use’ rather than ‘not recently in use’ is significant since it justifies remaining in the area in order to make a concerted effort to find the group.
- A population census should be carried out once the cubs of that year are participating fully in group activities, in many habitats this is during the end of the dry season.

General
- GPS coordinates should be recorded as decimal geographic degrees.
- All coordinates used for giant otter surveys must refer to the geodetic datum WGS 84.
- It is recommended that 10 km/hour be the maximum boat speed.

Golden rules

1. There is no correlation between campsite/den size and group size.
2. Sets of tracks are not a reliable indication of the number of otters in a group.
3. No studies to date have shown a correlation between the distribution and number of dens and campsites and the number of giant otter groups in the area or number of individuals within a group (i.e. giant otter abundance/density cannot be deduced from signs of giant otter presence).

Identifying / Ageing a Campsite or Den

- A cleared space is recorded as a campsite only if a layer of dispersed fish hard parts is present in the latrine area(s).
- A hole in the bank is only a giant otter den if dispersed fish hard parts and/or tracks leading up to, or in, the entrance are present.
- A campsite is only recorded as ‘recently in use’ if: (1) dispersed fish hard parts are present, (2) together with moist trampled vegetation and/or clear giant otter tracks leading up to, or in, the site.
- A den is only recorded as ‘recently in use’ if: (1) dispersed fish hard parts are present together with either moist trampled vegetation and/or clear tracks leading up to, or in, the entrance, (2) fish hard parts are absent, but moist trampled vegetation and clear tracks leading up to, or in, the site are present.
- It is very important to note that the evolution of sign appearance on a given campsite is:
  - highly weather related,
  - dependent on location (e.g. a campsite under dense, overhanging vegetation appears fresher for longer than one fully exposed on a beach), and
  - dependent on whether the otters have used the site repeatedly (visits may be spaced several days apart, or the site may be visited daily for a period of time).
- When there is doubt as to whether a den or campsite should be labelled ‘recently in use’ or ‘not recently in use’, then it is recorded as ‘not recently in use’.
- Tracks are only recorded if found not associated with dens and campsites, or if found on dens and campsites where the latrines have not been recently used.

Observing, Counting and Recording Giant Otters

- It is the giant otter’s characteristic throat marking as well as its larger size, domed skull, and rounded ears that distinguishes it from the Neotropical otter; the latter has a more flattened forehead, pointed ears, and lacks a marked throat pattern.
- When there is any doubt as to otter species, a giant otter sighting should not be recorded.
- Counting does not necessitate a periscoping situation but recording or identifying throat patterns often does.
- The number of individuals recorded is the total number of heads that are seen together above water at any single moment, or the total number of different neck markings filmed after an encounter.
- Total number of otters per group is not a criterion for group identification.
- The surveyor should aim for a 100% identification of individuals, but obtain a minimum of 60% of neck markings per group in order to identify it.
- If less than 60% of throat markings are obtained per group, two different sightings of groups must be spaced at least 40 km apart, for the groups to be considered different.
- Extra care must be taken when approaching or investigating dens, especially during the cub season. Surveyors should spend as little time as possible at den sites.

IDENTIFYING A CAMPSITE OR DEN	
Primary (essential) characteristics	**Secondary characteristics**
1. Presence of cleared space or hole in bank 2. Presence of dispersed fish hard parts 3. Presence of tracks	1. Presence of odour 2. Presence of insects 3. Presence of trampled vegetation

AGEING A CAMPSITE OR DEN	
Primary (essential) characteristics	**Secondary characteristics**
1. Presence of dispersed fish hard parts 2. Appearance of trampled vegetation 3. Clarity of tracks	1. Odour intensity 2. Presence / species of insects 3. Accumulation of leaf litter 4. Appearance of substrate in latrine area

[redacted]

NOT recently in use.

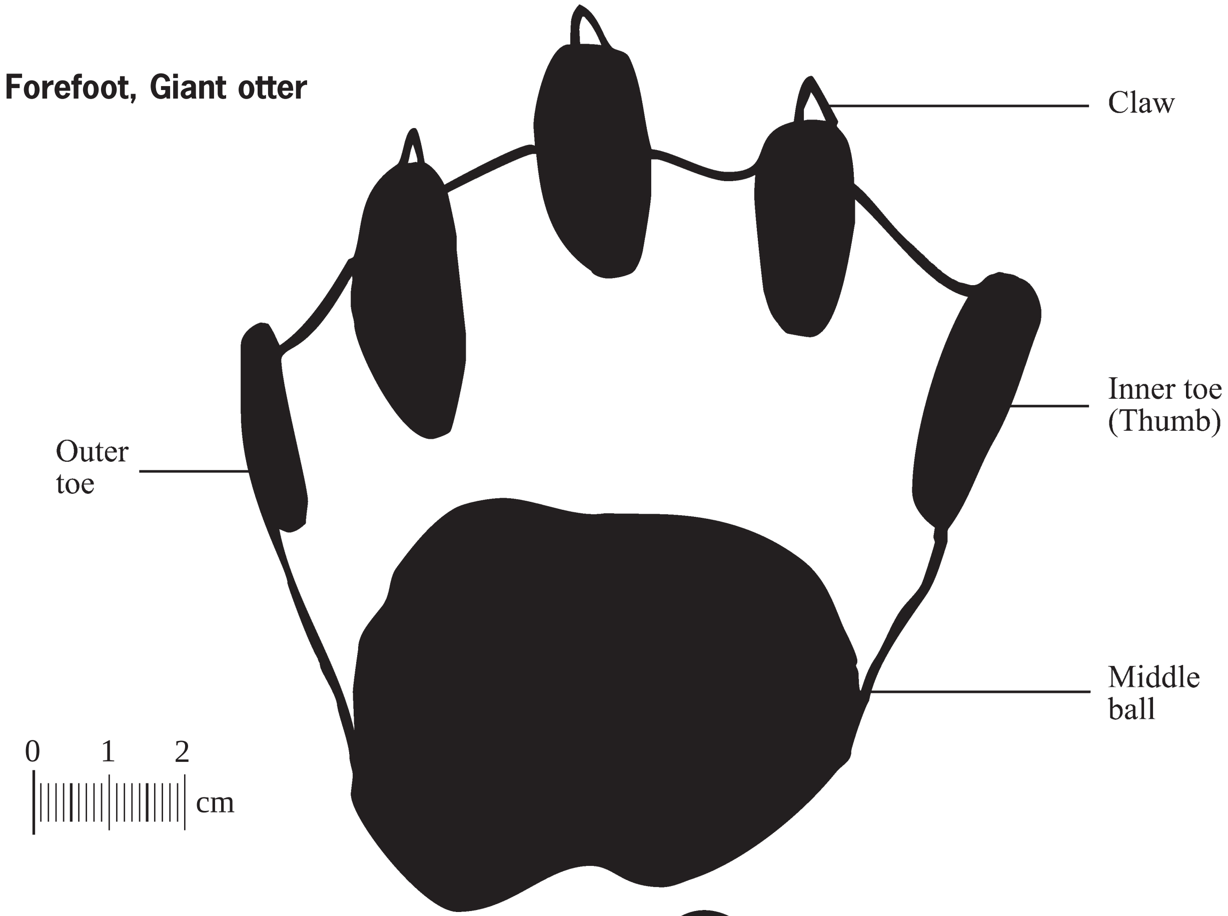
Yes

Qualifies as giant otter den

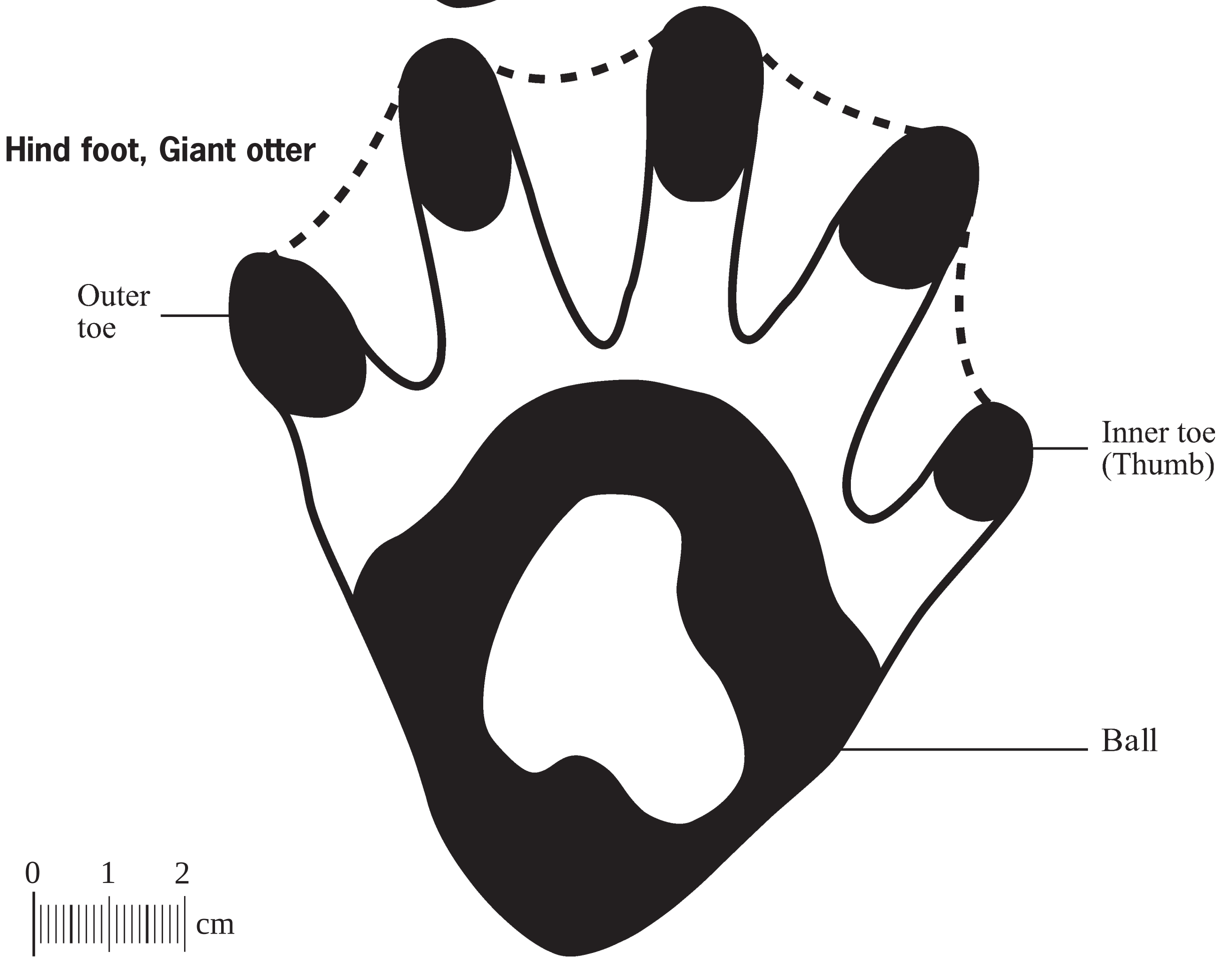
[redacted]

Forefoot and Hind Foot of the Giant Otter and the Neotropical Otter, life-sized.

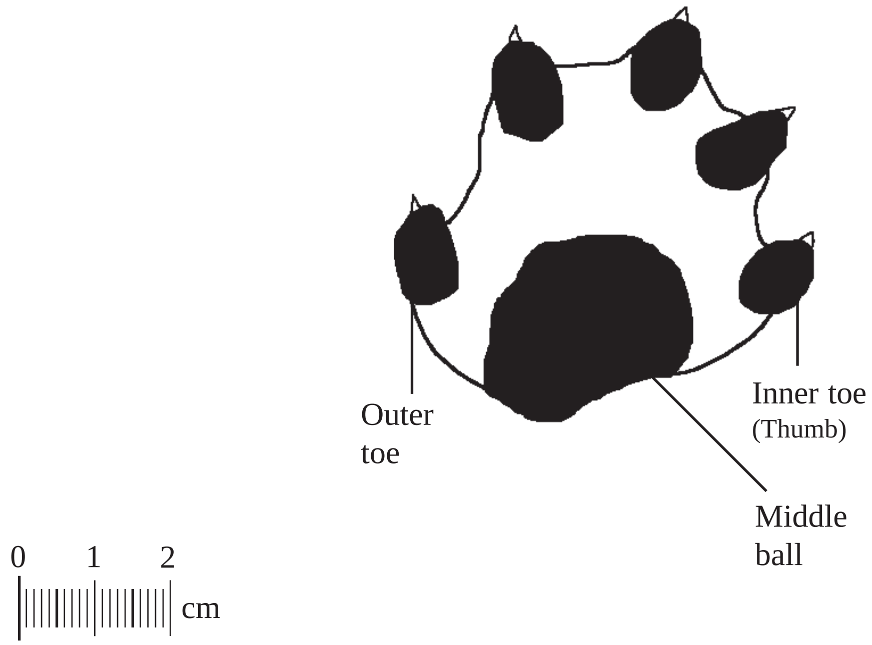
Forefoot, Giant otter



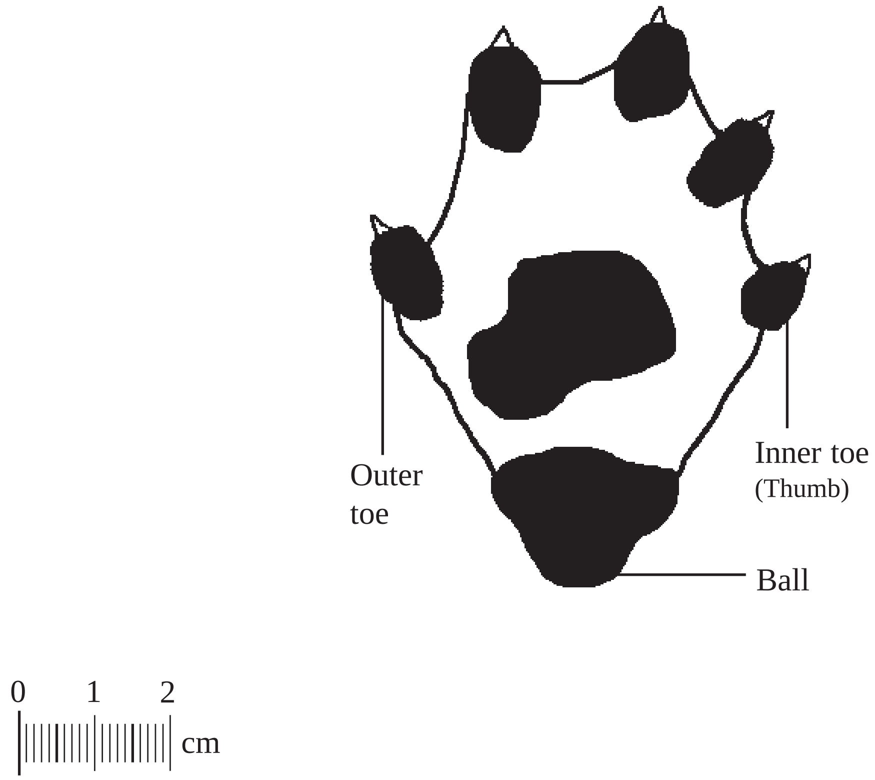
Hind foot, Giant otter



Forefoot, Neotropical otter



Hind foot, Neotropical otter



Appendix 3

Recommended Literature for Surveyors

The following all-round documents are recommended reading for surveyors before carrying out surveys:

CARTER, S.K., ROSAS, F.C.W. (1997): Biology and conservation of the Giant Otter *Pteronura brasiliensis*. - Mammal Rev. 27 (1): 1-26.

DUPLAIX, N. (1980): Observations on the Ecology and Behaviour of the Giant River Otter (*Pteronura brasiliensis*) in Suriname. - Rev. Ecol. (Terre Vie) 34: 496-620.

LAIDLER, P.E. (1984): The behavioural ecology of the giant otter in Guyana. - PhD Dissertation, University of Cambridge 1984; 319 pp.

SCHENCK, C. (1999): Lobo de Río (*Pteronura brasiliensis*) – Presencia, uso del hábitat y protección en el Perú. - GTZ / INRENA, Lima, Peru; 176 pp. Spanish translation of German PhD dissertation: Vorkommen, Habitatnutzung und Schutz des Riesenotters (*Pteronura brasiliensis*) in Peru (1996), Shaker Verlag, Munich, 178 pp.

STAIB, E. (2002): Öko-Ethologie von Riesenottern (*Pteronura brasiliensis*) in Peru. - PhD dissertation, Univ. München, Shaker Verlag, Munich, 199 pp. (currently being translated into Spanish).

A general giant otter bibliography list can be found at:
http://www.giantotterresearch.com/articles/FINALGOBiblioDivided.html

Appendix 4

Model for a Giant Otter Survey and Finding Report

Please note that the codes given for certain options (see, for example, Origin of data in Section A) are not necessarily in numerical order, and some may be missing. This is because the input mask for the ISOS database was first developed using survey experience for the Eurasian otter (Lutra lutra). With the addition of data for each new otter species, additional columns will be inserted into the input mask (not all have to be filled in for each species) but existing codes cannot be changed. Where codes are missing, this is because these options were not applicable to giant otter data.

A. BASIC DATA

Internal site number .... **Survey number** ....

Survey part of study ....

Grid Zone Designation (UTM zone) .... **100,000 m Square Identification** .... **Sub-quadrant code** ....

Date of survey/finding: Of survey site/finding ....

Of survey area: Start .... End ....

Origin of data: **11**= SDSM-GO; **12** = PCMG-GO; **5** = Other Syst. Surv. Nat.; **6** = Other Syst. Surv. Reg.; **7** = Acc. Field Data; **8** = Questionnaires; **9** = Literature

Usability of data: **1** = without limitation, **2** = for authorities only, **3** = for scientific objectives only, **4** = internal only

B. DESCRIPTION OF SURVEY SITE/AREA OR PLACE OF FINDING

Country .... **Region** .... **Geodetic datum** ....

GPS coordinates (starting point) – Decimal degrees: Latitude (hddd.ddddd) .... Longitude (hddd.ddddd) ....

GPS coordinates (end point) – Decimal degrees: Latitude (hddd.ddddd) .... Longitude (hddd.ddddd) ....

GPS coordinates (starting point) – UTM: Easting .... mE Northing .... mN

GPS coordinates (end point) – UTM: Easting .... mE Northing .... mN

Ave. height above sea level (altitude) .... m **Watershed** ....

Type(s) of habitat within survey site/area:

☐ River (ave. width .... m)

☐ Canal (ave. width .... m)

☐ Lake (appr. size: .... ha)

☐ Reservoir (appr. size .... ha)

☐ Swamp/marsh

☐ Other ....

Water level: 1 = flooding, **2**= high, **3** = normal, **4** = low, **5** = extremely low, **6** = standing water in pools, **7** = dry, **8** = tidal influence

C. DETAILS OF SURVEY METHOD

DISTRIBUTION SURVEY ONLY

Total search distance: ☐ Standard (20km) ☐ .... km **Type of survey**: **1**= stop-at-first-sign, **2**= full distance

Remarks: ....

....

....

....

POPULATION CENSUS ONLY

Sub-quadrant investigated: 1= Completely investigated **2**= Partially investigated If latter, state approximate area covered: km2

Remarks: ....

....

....

....

D. RESULTS / FINDINGS

DISTRIBUTION SURVEY ONLY

Overall site rating: 1 = positive, **2** = negative

Distance from start-point to first sign .... km

[redacted]

Kinds of proof: 1 = Finding living animal, **2** = Finding dead animal, **3** = Observation of living animal, **4** = Footprints/Tracks, **5** = Campsite, **9** = Reproduction/cubs, **10** = Den

Remarks: ....

Documentary evidence: **1** = Living specimen, **2** = Complete carcass, **3** = Fur (of carcass), **4** = Skull (of carcass), **5** = Photo/Video,

6 = Cast/drawing of track, **7** = Scat / spraint, **9** = Other: .... , **10** = No evidence

Cause of finding live / dead animal: **1** = Traffic, **2** = Fish trap, **3** = Beaten dead, **4** = Shot dead, **5** = Killed in trap, **6** = Caught alive, **7** = Illness,

8 = Other: .... , **9** = Unknown, **10** = Other animal

POPULATION CENSUS ONLY
Total number of individuals encountered in sub-quadrant: ....

Detailed findings:

NAME OF AREA	DATE & TIME	GPS POSITION OF PROOF (UTM)		LOCATION DESCRIPTION FOR PROOF	KIND OF PROOF							DURATION OF SIGHTING (proof 3)	USE OF CAMPSITE OR DEN (proofs 5 or 10)	DOCUMENTARY EVIDENCE			CAUSE (proofs 1 or 2)	REMARKS
		Easting	Northing		1	2	3	4	5	9	10	minutes						

Kind of proof: .... **1** = Finding living animal, **2** = Finding dead animal, **3** = Observation/sighting of living animal, **4** = Footprints/Tracks, **5** = Campsite, **9** = Reproduction/cubs, **10** = Den

Use of campsite or den: .... **1** = recently in use, **2** = not recently in use

Documentary evidence: .... **1** = Living specimen, **2** = Complete carcass, **3** = Fur (of carcass), **4** = Skull (of carcass), **5** = Photo/Video, **6** = Cast/drawing of track, **7** = Scat / spraint, **9** = Other: .... , **10** = No evidence

Cause of finding live/dead animal: **1** = Traffic, **2** = Fish trap, **3** = Beaten dead, **4** = Shot dead, **5** = Killed in trap, **6** = Caught alive, **7** = Illness, **8** = Other: .... , **9** = Unknown, **10** = Other animal

E. ORIGIN OF DATA AND WHEREABOUTS OF DOCUMENTARY EVIDENCE

Surveyor/Finder

Surname .... Forename .... ☐ Mr. ☐ Mrs. Title ....

Street .... Postal code .... City ....

Country .... State/province ....

Phone .... Fax .... E-mail ....

Remarks ....

Messenger

Surname .... Forename .... ☐ Mr. ☐ Mrs. Title ....

Street .... Postal code .... City ....

Country .... State/province ....

Phone .... Fax .... E-mail ....

Remarks ....

....

Publication

Name(s) of authors ....

Year of publication .... Title of publication ....

BOOKS WHICH ARE COMPLETELY WRITTEN BY THE AUTHOR(S) MENTIONED ABOVE

Name of publisher .... Place of publication ....

Total number of pages ....

BOOKS WHICH HAVE (AN) EDITOR(S) AND CONTAIN CONTRIBUTIONS BY DIFFERENT AUTHORS

pp. .... -................ Name(s) of editor(s) ....

Title of the book ....

(Name of the series and number of issue in the series) ....

Name of publisher .... Place of publication ....

Total number of pages ....

SCIENTIFIC JOURNALS

Name of the Journal ....

Number of volume .... Number of issue .... Number of first and last page of publication ....-................

Whereabouts of documentary evidence

Kind of documentary evidence .... Name of institution ....

Contact person/Forename, Surname): .... ☐ Mr. ☐ Mrs. Title ....

Street .... Postal code .... City ....

Country .... State/province ....

Phone .... Fax .... E-mail ....

Remarks ....

Kind of documentary evidence .... Name of institution ....

Contact person/Forename, Surname): .... ☐ Mr. ☐ Mrs. Title ....

Street .... Postal code .... City ....

Country .... State/province ....

Phone .... Fax .... E-mail ....

Remarks ....

Kind of documentary evidence .... Name of institution ....

Contact person/Forename, Surname): .... ☐ Mr. ☐ Mrs. Title ....

Street .... Postal code .... City ....

Country .... State/province ....

Phone .... Fax .... E-mail ....

Remarks ....

F. RESULTS OF ADDITIONAL EXAMINATIONS

Biometric data

Sex: ☐ female ☐ male ☐ unknown
Age: ☐ estimated ☐ analysed Method of analysis ....

Age data: .... YY .... MM Weight in g ....

Length in cm: Body length .... Tail length .... Total length ....

Remarks (additional biometric data) ....

Specific analysis

PCB's ....

Heavy metals ....

Other toxic substances ....

Illnesses/injuries ....

Genetic analysis ....

Steroid hormones ....

Reproduction/foetus ....

Other findings ....

Giant Otter Survey and Finding Report – term definitions/explanations –

A. BASIC DATA

Internal site number – As practice shows, it is difficult to handle site identification (e.g. in correspondence) if it is labelled by coordinates or descriptions of locations only, especially if a large number of sites are dealt with. This is also true if results of survey repetitions are to be compared by computer analysis using coordinates, as it is common that localisation of a survey site by coordinates (on the basis of map interpretation or GPS readings) results in different values. These might be marginal (i.e. on the one metre level) but, for the computer, this means a different point and it will not be possible to undertake a comparison of, for example, the results of different surveys for this site. Therefore, it is suggested that sites be labelled by ISOS using 'internal site numbers'. For comparisons of results of different surveys, these numbers will be used, instead of the coordinates, to identify those sites which should be compared.

Survey number – To ensure that, in the case of survey repetitions, the results of a survey (carried out by the same method) will be related to the correct repetition, each survey should be numbered. First survey is number 1, second number 2, etc.

Survey part of study – Since it can happen that a survey site forms part of a different survey (e.g. a regional study which is repeated twice a year or a regional study which is repeated each second year) individual labelling of the different studies will allow a detailed selection of a specific survey/study. It is important that, for all sites and for all repetitions, exactly the same name for the survey/study is used, as otherwise the computer cannot relate the results to a specific survey. It is suggested that the period (i.e. month(s), year(s)) which define this survey be used in combination with a name for a specific survey/study (e.g. "Range-wide Distribution Survey South America 2004-2011" or "National Distribution Survey Bolivia 2005" or "Manu Population Census 2004").

Grid Zone Designation – UTM maps provide the Grid Zone Designation (this is found in the map's legend in a blue/violet rectangle or grid reference box). The Grid Zone Designation consists of two digits and one letter and refers to the UTM Zone. This information is included in the Survey and Finding report for surveyor reference in the field.

100,000 m Square Identification – The 100,000 m (or 100 km) Square Identification is also given together with the Grid Zone Designation; this explains which 100 km squares are (partially) covered by this map, using two letters. This information is included in the Survey and Finding report for surveyor reference in the field.

(Sub) quadrant code – In all SDSM-GO surveys, whether at the 100x100 km, 50x50 km, or 25x25 km grid level, the standard is to survey a minimum of one sub-quadrant of 25-25 km. In all PCMG-GO surveys, a survey and finding report is completed for each 25x25 km sub-quadrant (partially) investigated. **Each (sub) quadrant of 25x25 km is given a unique code name consisting of a letter (A, B, C or D) and a number (1 to 4 for each of the four letters).** A 100x100 km square is divided into four 50x50 km quadrants. These are always labelled A, B, C and D, such that, when we refer to quadrant C, we know that this always means the quadrant in the bottom, left-hand corner of the 100x100 km square. A 50x50 km quadrant is divided into four sub-quadrants, always numbered 1 to 4 for each letter. So sub-quadrant B2 is always in the top right hand corner of the 100x100 km square (see diagram below). This information is included in the Survey and Finding report for surveyor reference in the field.

A1	A2	B1	B2
A3	A4	B3	B4
C1	C2	D1	D2
C3	C4	D3	D4

Date of survey/finding
Of survey site/finding: the day of examination of the survey site using the SDSM-GO, recorded according to the European method (dd/mm/yyyy). In the case of accidental findings of evidence, or findings from questionnaires or publications, this date refers to the day the evidence was found (if mentioned).
Of survey area: a survey carried out using the PCMG-GO may be carried out over several weeks so the starting date as well as the end date of investigation are recorded according to the European method (dd/mm/yyyy).

Origin of data
11 = SDSM-GO – as outlined in the document. It is the aim to store mainly data resulting from surveys carried out by the SDSM-GO. As long as the latter is not used over the whole range of the species, however, data resulting from other sources can also be considered, as indicated below.
12 = PCMG-GO – as outlined in the document. It is the aim to store mainly data resulting from censuses carried out using these census guidelines. As long as the latter are not used over the whole range of the species, however, data resulting from other sources can also be considered, as follows:
5 = Other Syst. Surv. Nat. – Other systematic national field surveys (covering the whole area of a country)
6 = Other Syst. Surv. Reg. – Other systematic regional field surveys (covering an area below the country level)
7 = Accidental Field Data – all field data not resulting from systematic surveys (e.g. reports from other scientists)
8 = Questionnaires – all data collected by means of questionnaires/interviews
9 = Literature – post 1990 data obtained from publications.

Usability of data
1 = without limitation
These data are free for all (non-commercial!) purposes and objectives. If the data are used (e.g. for a publication) by ISOS, whenever possible the origin of the data (name of finder or messenger) will be reported. If the data are made available to other institutions, these have to sign a declaration that they will reference all persons/institutions who have submitted data and that they will not use the data for commercial purposes.

2 = for authorities only
These data will be made available to authorities (governmental agencies, international conservation organisations) exclusively. These institutions will have to sign a declaration that they will use the data for internal purposes only, that they will neither publish the data nor transfer the data to a third party without the personal permission of the person/institution which submitted the data to ISOS.

3 = for scientific objectives only
These data will be made available to scientific institutions (e.g. universities) exclusively. These institutions will have to sign a declaration that they will use the data for scientific purposes only, and that they will not transfer the data to a third party without the personal permission of the person/institution which submitted the data to ISOS. In the case of publication of the results of the studies or analysis the data are used for, they will reference all persons/institutions that submitted the data.

4 = internal only
These data will only be stored in ISOS and will not be used for publications by ISOS (e.g. of maps) or made available to any other person/institution (governmental or scientific) without the personal permission of the finder/messenger. The only use ISOS can make of these data are summarising analyses of the ISOS data bank resources (e.g. distribution of data for specific periods or percentage of specific information stored in ISOS).

All data sets offered to ISOS without a declaration for the use of data will automatically be stored as 'without limitation'.

B. DESCRIPTION OF SURVEY SITE/ AREA OR PLACE OF FINDING

Country – The name of the country should be written completely and not abbreviated.

Region – The name of the first administrative level below the national level (e.g. counties, departments, districts, regions, states, provinces etc.), written completely.

Geodetic datum – the geodetic datum used for the GPS reading: WGS 84 is the standard.

GPS coordinates (starting point) / GPS coordinates (end point)
Geographic degrees**:** written in the hddd.ddddd position format. This is compulsory for ISOS i.e. all GPS coordinates **must** be stated in this format as a minimum.
UTM: written as Easting (mE) and Northing (mN) (e.g. 503983 mE. 8601597 mN where 503983 mE is the Easting and 8601597 is the Northing). This is for surveyor reference only, to facilitate location of the GPS position on maps during fieldwork. There is no possibility to include UTM coordinates in the ISOS database.

Ave. height above sea level (altitude) – determined from topographic map (if this is not possible then use GPS) and valuable for calculations of distribution and recovery tendencies.

Watershed – name of the watershed to which the site/area belongs. 'Watershed' may be defined as the surface area covered by all the waters that drain towards one point, at whatever scale.

Type(s) of habitat within survey site/area - Different categories for a ROUGH classification representing most of the types of typical otter habitats which can be differentiated on a national level, are defined as follows:

'River'	Running waters of any size (including creeks) which are not classified as canal (or ditch). The approximate width of the river/creek (over the survey distance/area or the point of finding), should be given in metres.
'Canal'	Artificial water courses obviously constructed for human use (includes ditches). The approximate width of the canal/ditch (over the survey distance/area or the point of finding) should be given in metres.
'Lake'	Standing waters of any size (including ponds) that are natural in origin. The approximate size of the water surface of the lake surveyed (including islands and areas covered in floating aquatic vegetation), should be given in hectares (100x100m).
'Reservoir'	Standing waters of any size which are artificial in origin, and where the water level is controlled predominantly by human activities. The approximate water surface area (including islands and areas covered in floating aquatic vegetation), should be given in hectares (100x100 m).
'Swamp/marsh'	Swampy areas which cannot be classified as flowing or standing waters. May be seasonal.
Other	All habitats that do not fit into this classification system. Please state.

Water level – water level can possibly influence the survey result:

1 = flooding	Rivers or standing waters where the water level has overflowed the banks, causing flooding of adjacent areas which are not usually covered by water.
2 = high	A water level which is above the 'normal' level but which has not overflowed the banks of the river or standing water, and which has not flooded the surrounding area.
3 = normal	The water level which is typical for the major part of the year for this water, usually possible to estimate by the vegetation on the banks.
4 = low	A water level which is lower than the 'normal' level but cannot yet be classed as 'extremely low'.
5 = extremely low	A water level which is very much lower than the 'normal' water level, close to drying up, but still displaying a continuous water surface over the whole length of a river or of a standing water.
6 = standing water	The dominant part of the riverbed, or of the floor of a standing water, is dry though still in pools showing some isolated pools of open water (i.e. not mud or swamp).
7 = dry	All water is completely gone and there are no more pools of open water on the floor of a river or standing water.
8 = tidal influence	Waters which are influenced by the tides of an adjacent saltwater sea.

C. DETAILS OF SURVEY METHOD

DISTRIBUTION SURVEYS ONLY – This is the section to record data arising from distribution surveys.

Total search distance – The standard search distance of the SDSM-GO is 20 km. If any other distance is used as a guideline then that has to be noted in kilometres.

Type of survey – When giant otter sign or other proof is found at any point within the standard survey distance, the site can be treated as positive and abandoned. This is known as a 'stop-at-first-sign' survey. The alternative is to investigate the full survey stretch even if the site is found to be positive at an early stage, in order to collect additional data for specific studies (e.g. for the evaluation of the SDSM-GO). If the guideline for this survey is to stop at the first giant otter sign or other proof, and the full search distance was examined (because no otter sign could be found), then the 'stop-at-first-sign' option should still be marked.

Remarks – Special findings/conditions/circumstances (e.g. modifications of the SDSM-GO) which may have influenced the method or results should be recorded here. If a systematic distribution survey method other than the SDSM-GO has been used, this should also be described here.

POPULATION CENSUS ONLY – This is the section to record data arising from population censuses.

Extent of sub-quadrant investigated – If all aquatic habitats potentially harbouring the species in the complete sub-quadrant are investigated the 'completely investigated' option is chosen. If all aquatic habitats potentially harbouring the species within a fraction of the sub-quadrant are investigated the 'partially investigated' option is chosen. If the latter is chosen the approximate area investigated (in km^2) must be noted.

Remarks – special findings/conditions/circumstances (e.g. modifications of the PCMG-GO) which may have influenced the method or results should be recorded here. If a systematic population census method other than the PCMG-GO has been used, this should also be described here.

D. RESULTS / FINDINGS

DISTRIBUTION SURVEYS ONLY – This is the section to record data arising from distribution surveys.

Overall site rating – The overall rating of the site as'positive' or 'negative' is defined as:

1 = positive	A giant otter sign or other proof was found during the survey
2 = negative	No giant otter sign or other proof was found during the survey

Distance from survey site start-point to first sign – The surveyor should *always* record the distance, in kilometres, at which the first sign or other proof was encountered irrespective of whether it is a stop-at-first-sign or full distance survey (this data will eventually help us define the ideal survey site distance). This means that the GPS has to be left on during each survey until the first sign or other proof is encountered (using the odometer function), so that actual distance along the bends of the river is measured, not a straight line between the start-point and first sign.

Detailed findings – For distribution surveys based on the guideline of investigating the full standard survey distance, details of up to 10 proofs can be documented in the table. For 'stop at first sign' surveys, only one line will be completed. Accidental field data or findings from inquiries or literature can also be recorded.

Kinds of proof – There are 7 kinds of proof which are coded and defined as follows:

1 = Finding living animal	It may be rare, but is possible, that a living specimen is found (injured or orphaned). In contrast to proof no. 3 (observation), it is not enough to observe a giant otter, it must have been taken into custody (being kept as a pet, enclosure, veterinarian, etc.).
2 = Finding dead animal	Each giant otter which is found dead, independent of the cause of death or the condition of the carcass.
3 = Observation/Sighting of living animal	Reliable observations / sightings of living giant otters in their habitat under natural circumstances. Only those observations made by experienced people, or surveyors with a minimum of training, or observations which are supported by documentary evidence, should be accepted.
4 = Footprints /Tracks	Footprints/Tracks which are positively identified as giant otter footprints.
5 = Campsite	A campsite must be identified as giant otter sign using the relevant key in **Chapter 2**.
9 = Cubs	It should be used only if the evidence or indication for the occurrence of cubs is reliable (e.g. by observing the cubs on land and therefore being able to see their size). A description of the finding and the argument for its reliability must be added to **Remarks**.
10 = Den	A den must be identified as giant otter sign using the relevant key in **Chapter 2.**

Number Observed – The number observed in the report refers to the total number of individuals (for proofs **1**, **2**, **3**) or to the number of cubs (for proof **9**) which are found at one point within the survey. For proofs **4, 5** and **10** this will be equal to 1 ie. 1 set of footprints or 1 campsite or 1 den.

GPS Location – Refers to the UTM GPS coordinates for the proof.

Documentary evidence – There are ten categories for documentary evidence for the kind of proof found, defined as follows:

1 = Living specimen — A living giant otter which has been taken into custody (enclosure, vet, etc.).

2 = Complete carcass — A complete carcass of a giant otter found dead.

3 = Fur (of carcass) — The fur of a giant otter found dead.

4 = Skull (of carcass) — The skull of a giant otter found dead.

5 = Photo — Photograph or video of the proof (living or dead animal, scat/campsite, footprint/track,etc.).

6 = Cast/drawing of track — Plaster cast or drawing (life-sized and copied on transparent paper directly from the original imprint on the ground) of a footprint.

7 = Scat/spraint — The scat / spraint itself.

9 = Others — Other forms of documentary evidence with a short description.

10 = No evidence — No documentary evidence available.

Since it is possible that more than one form of documentary evidence is stored (e.g. fur and skull of a dead otter found separately), there are three spaces provided to give the appropriate codes.

Remarks – Special findings / conditions / circumstances should be described here.

Cause of finding live / dead animal – There are ten categories for the cause of finding dead or living specimens (kinds of proof 1 and 2), defined as follows:

1 = Traffic — Injured/killed by a road vehicle (giant otters killed by boats should be reported in category ***8*** = Other).

2 = Fish trap — Injured/killed in a fish or crustacean trap (i.e. nets, other fishing gear).

3 = Beaten dead — Killed by humans by striking the giant otter with some object.

4 = Shot dead — Killed by humans by shooting.

5 = Killed in trap — Killed by humans by using a mammal trap (not a fish trap, if the latter is the case see ***2*** = Fish trap)

6 = Caught alive — Caught or found alive (independent of the method or the reason for catching and independent if the animal will die soon after being caught or found).

7 = Illness — Affected / killed by illness, independent of the kind of illness (most dead giant otters which cannot be related to categories ***1*** - ***5*** will belong to this category).

8 = Other — Other reasons for the finding of dead or living giant otters which can be clearly ascertained, but which cannot be related to one of the above categories (with a short description).

9 = Unknown — No reliable data/causality available.

10 = Other animal — Injured / killed by another animal including other giant otters.

POPULATION CENSUS ONLY – This is the section to record data arising from population censuses.

Total number of individuals encountered in sub-quadrant – This is the total number of giant otters unequivocallly identified during the census, within the sub-quadrant being investigated.

Detailed findings – During a census literally hundreds of proofs may be found, and so tabular recording is required. Multiple copies of the table provided should be taken to the field. Census data reported in the literature can also be recorded via this table.

Name of area – the name of the specific area within the census area where the proof was observed (e.g. a specific lake or river).

Date and time – the date and time at which the proof was found. The date should be written as dd/mm/yyyy and the time according to the 24 hour clock (e.g. 4pm should be recorded as 16:00).

GPS position of proof – refers to the UTM GPS coordinates of the proof.

Location description of proof – short description of the sign or other proof location e.g. where a creek meets the main river, or where a creek enters or exits a lake, or at a cross-over (short cut) point on a sharp bend of the river, etc. The bank on which the proof is

found should also be stated. LBD-Left Bank going Downstream, RBD-Right Bank going Downstream, indicating whether the sign is located on the Left or Right Bank, always determined as such in the Downstream direction (this means that a sign encountered on the right bank while travelling upstream, is recorded as LBD). This aids re-identification of the proof during survey repetitions (monitoring). Not applicable to sightings or finding of live / dead animals.

Kind of proof – There are 7 kinds of proof which are coded and defined as follows:

1 = Finding living animal — It may be rare, but is possible, that a living specimen is found (injured or orphaned). In contrast to proof no. 3 (observation), it is not enough to observe a giant otter, it must have been taken into custody (being kept as a pet, enclosure, veterinarian, etc.).

2 = Finding dead animal — Each giant otter which is found dead, independent of the cause of death or the condition of the carcass.

3 = Observation /Sighting of living animal — Reliable observations / sightings of living giant otters in their habitat under natural circumstances. Only those observations made by experienced people, or surveyors with a minimum of training, or observations which are supported by documentary evidence, should be accepted.

4 = Footprints /Tracks — Footprints/Tracks which are positively identified as giant otter footprints.

5 = Campsite — A campsite must be identified as giant otter sign using the relevant key in **Chapter 2**.

9 = Cubs — It should be used only if the evidence or indication for the occurrence of cubs is reliable (e.g. by observing the cubs on land and therefore being able to see their size). A description of the finding and the argument for its reliability must be added in **Remarks**.

10 = Den — A den must be identified as giant otter sign using the relevant key in **Chapter 2.**

In the table, only 1 box per proof must be filled. If the proof is of kind **1**, **2** or **3,** the total number of individuals should be entered in the appropriate space, while for kind **9** it is the number of cubs. For proofs **4, 5** and **10** this will be equal to 1, since campsites, dens and sets of tracks are all marked individually.

Duration of sighting – total direct observation time.

Use of campsite or den – This is marked with a ***1*** if the campsite or den is **recently in use** and with a ***2*** if the campsite or den is **not recently in use**. Please refer to the relevant keys in **Chapter 2.**

Documentary evidence – There are ten categories for documentary evidence for the kind of proof found, defined as follows:

1 = Living specimen — A living giant otter which has been taken into custody (enclosure, vet, etc.).

2 = Complete carcass — A complete carcass of a giant otter found dead.

3 = Fur (of carcass) — The fur of a giant otter found dead.

4 = Skull (of carcass) — The skull of a giant otter found dead.

5 = Photo — Photograph or video of the proof (living or dead animal, scat/campsite, footprint/track, etc.).

6 = Cast/drawing of track — Plaster cast or drawing (life-sized and copied on transparent paper directly from the original imprint on the ground) of a footprint.

7 = Scat/spraint — The scat / spraint itself.

9 = Others — Other forms of documentary evidence with a short description.

10 = No evidence — No documentary evidence is available.

Since it is possible that more than one form of documentary evidence is stored (e.g. fur and skull of a dead otter found separately), there are three spaces provided to give the appropriate codes.

Cause of finding live / dead animal – There are ten categories for the cause of finding dead or living specimens (kinds of proof 1 and 2), defined as follows:

1 = Traffic — Injured / killed by a road vehicle (giant otters killed by boats should be reported in category **8** = Other).

2 = Fish trap — Injured / killed in a fish or crustacean trap (i.e. nets, other fishing gear).

3 = Beaten dead — Killed by humans by striking the giant otter with some object.

4 = Shot dead — Killed by humans by shooting.

5 = Killed in trap — Killed by humans by using a mammal trap (not a fish trap, if the latter is the case see **2** = Fish trap)

6 = Caught alive — Caught or found alive (independent of the method or the reason for catching and independent if the animal will die soon after being caught or found).

7 = Illness — Affected / killed by illness, independent of the kind of illness (most dead giant otters which cannot be related to categories **1** - **5** will belong to this category).

8 = Other — Other reasons for the finding of dead or living giant otters which can be clearly ascertained, but which cannot be related to one of the above categories (with a short description).

9 = Unknown — No reliable data/causality available.

10 = Other animal — Injured / killed by another animal including other giant otters.

Remarks – these should include names and/or sex of any individuals recognised, any special observations, etc.

E. ORIGIN OF DATA AND WHEREABOUTS OF DOCUMENTARY EVIDENCE

Surveyor/Finder – It is essential to have the full address of the person who investigated the site (in surveys) or who made the finding (of accidental data or of data which are part of a questionnaire or are published in literature). If the data source is a questionnaire or publication, the 'finder' is the person who made the original observation (not necessarily the same person who filled out the questionnaire or the person who published the data).

Messenger – 'Messengers' are people who contribute data provided by others (so did not make the observation themselves); they include authors of questionnaire results or of publications.

Publication

Name(s) of authors – Surname (not written in capitals), first letter(s) of the forename(s)
Example: Miller, A.B.
If there is more than one author, a semicolon separates the author's names
Example: Miller, A.B.; Jones, C.D.; Smith, E.F.

Year of publication – Year of publication – As given in the editorial of the publication

Title of publication – Title of publication – Full title, without abbreviations. If the publication is part of a book containing contributions by different authors (Proceedings, etc.) the 'Title of publication' is not the title of the book but the title of the publication of the author(s) mentioned previously.

There are three main formats for the quotation of the source of publications:

BOOKS WHICH ARE COMPLETELY WRITTEN BY THE AUTHOR(S) MENTIONED ABOVE
- Name of publisher
- Place of publication (if various places are given, only the first is recorded here)
- Total number of pages
  Example: Oxford University Press, Oxford, 310pp.

BOOKS WHICH HAVE (AN) EDITOR(S) AND CONTAIN CONTRIBUTIONS BY DIFFERENT AUTHORS
- Number of first and last page of the contribution this quotation is referring to
- Name(s) of editor(s) (written as described for authors above)
- Title of the book
- Name of the series and number of issue in the series
- Name of publisher
- Place of publication (if various places are given, only the first is recorded here)
- Total number of pages
  Example: pp. 162-177 in: Reuther, C.; Rowe-Rowe, D. (eds.): Proceedings VI. International Otter Colloquium Pietermaritzburg 1993, Habitat No. 11, Aktion Fischotterschutz,Hankensbüttel, 146pp.

SCIENTIFIC JOURNALS
- Complete name of the Journal (no abbreviations)
- Number of volume
- Number of issue
- Number of first and last page of publication
  Example: Journal of Zoology 16(1): 112-120

Whereabouts of documentary evidence

Knowledge of the whereabouts of documentary evidence can be an important contribution for an evaluation of findings or for further analysis. It is therefore necessary to give the name and the address of the person or institution from which the documentary evidence was received. The report contains three columns to store up to three entries of different documentary evidences at different institutions.

F. RESULTS OF ADDITIONAL EXAMINATIONS

ISOS offers the possibility to store results of additional examinations referring to animals found dead or alive or, for example, from scat analysis. This part of the data bank is mainly related to accidental findings and less to survey results. These examination results are separated into two sections, biometric data of otters and specific analyses of dead/alive specimens or of scats.

Biometric data
All available data are stored referring to the sex, age, and the size of an otter found dead or alive. The following parameters are considered:

'Sex' — Three categories are accepted, 'female', 'male' and animals of 'unknown' sex. The latter category is added for carcasses where the sex of the animal is impossible to determine.

'Age' — For a better assessment of the 'Age' data, it has to be specified if the age was 'analysed', by methods such as the counting of incremental rings in the dentine of the teeth, or if the age was only 'estimated'. The name of the method used to analyse age needs to be given.

'Age data' — Even if the age is 'analysed' (e.g. by counting of incremental rings in the dentine of teeth) it may only be possible to give a rough value. It will therefore be sufficient to give the age in years (YY) and/or months (MM).

'Weight' — The weight is given in full grams (e.g. not 12,154 but 12154). To ensure comparable data, only the weight of living animals or of complete carcasses (including fur and all organs) should be given here. The weight of incomplete carcasses, or special circumstances that could have influenced the weight measurements, should be given in the 'Remarks' column.

'Length' — There are three commonly used measurements for the length: 'Body length' (from the tip of the nose to the anus/root of the tail), 'Tail length' (from the anus/root of the tail to the tip of the tail), and 'Total length' (from the tip of the nose to the tip of the tail). If at least two of these measurements are available, ISOS will calculate the third measurement automatically. The length measurements are given in centimetres to one decimal place (e.g. 52,6 cm as 52.6).

Specific analysis

If the results of specific analyses are available they can be stored as text in the databank. The following columns are available:

PCB's — Results of PCB analysis of tissues of living or dead animals or of scats.

Heavy metals — Results of heavy metal analysis of tissues of living or dead animals or of scats.

Other toxic substances — Results of analysis of tissues of living or dead animals or of scats for other toxic substances.

Illnesses/injuries — Results referring to illnesses or injuries based on post mortem analysis or the examination of living animals.

Genetic analysis	Results of genetic analysis of tissues of living or dead animals or of scats.	Since results are only comparable if methods of analyses are known a short description should be given (e.g. kind of organs which are analysed, reference parameters, etc.). Though it goes beyond the scope of ISOS to ensure a complete collection of all details of such analyses or to interpret these results. The intention is to collect information where which kinds of analyses were carried out. This information will be offered to scientists who are interested in specific themes and will enable them to contact those institutions which carried out these analyses.
Steroid hormones	Results of analysis of steroid hormones in scats.	
Reproduction /Foetus	Results of examinations for signs of reproduction (e.g. scarring of uterus) or of foetuses.	
Other findings	Additional data of other analyses that might be available can be mentioned here.	

Appendix 5

Jessica GROENENDIJK, Rob WALLACE

Model for a Giant Otter Survey Questionnaire

How to use this questionnaire: It is intended for local people living in potential giant otter habitat (i.e. not for researchers or scientists), and should be conducted by the interviewer (so not sent as a hard copy to be completed by the interviewee). Photographs or drawings of different animals, including non-aquatic species, could be used for question 6. It is important not to ask leading questions, where the answer is provided within the question itself, since some people will anticipate what you want to hear and will try to please. For example, when requesting a description of the otter (question 7), rather than asking "Is the otter large?", ask "What size is the otter?". Instead of asking "Does it raise its head out of the water (periscope) and snort?", ask "What does it do when it sees you?". Care should be taken with question 12, when enquiring about human presence/ activities in the area, not to sound critical or confrontational.

1. ***Questionnaire no.*** ____________________
2. ***Date of completion*** ____________________
3. ***Name and address of interviewer*** ____________________

   ____
4. ***Name of interviewee and name of community where from (state coordinates if possible)***

   ____
5. ***Estimated age class of interviewee (do not ask)***

   ☐ ≤ 15 yrs ☐ 15 – 30 yrs ☐ 30 – 45 yrs ☐ 45 – 60 yrs ☐ ≥ 60 yrs
6. ASK: ***"What fish-eating animals are you familiar with/do you recognize"*** (if photos/drawings are used)**?**
   If otters are mentioned, go to 7
   If otters are not mentioned, go to 8
7. ***Ask for a description of the otter (size, colour, shape of tail, etc.) and/or its behaviour (periscoping, in groups or solitary?)***
   If description is typical of giant otter, go to 9
   If description is typical of Neotropical otter, go to 8
8. SHOW PICTURE OF GIANT OTTER, ASK: ***"Do you know this animal?"***
   If the answer is no, go to 18
   If the answer is yes, ask for the local word for giant otter, and go to 9
9. ASK: ***"When did you last see giant otters?"*** If reply suggests:
   ☐ Within the last 6 months (go to 10)
   ☐ Between 6 months and 1 year ago (go to 11)
   ☐ Between 1 and 2 years ago (go to 11)
   ☐ Between 2 and 5 years ago (go to 11)
   ☐ More than 5 years ago (go to 11)
10. ***Ask for more precise information***

    ☐ In last week ☐ In last month ☐ In last 6 months
11. ASK: ***"Where did you see giant otters?"*** (name of community or of location, use map if possible. If using map also record approximate coordinates)

    ____

12. ***Ask for a short description of the habitat*** (water colour e.g. whitewater / blackwater, indication of flow rate, human presence/activities, vegetation type(s), bank substrate type(s), etc.)

____

____

Mark the type of habitat where otters were seen:

☐ lake ☐ reservoir ☐ river ☐ creek ☐ canal ☐ swamp

☐ other (specify) ______________________________

13. ASK: ***"Were you on land or on a boat?"***
☐ On land (go to 15)
☐ On a boat (go to 14)

14. ASK: ***"Travelling with or without a motor?"***
☐ With
☐ Without

15. ASK: ***"How did the giant otters react?"***

____

____

16. ASK: ***"Have you seen giant otters in other places?"***
☐ No
☐ Yes – Repeat 11 to 15 for each observation (use table at end of questionnaire)

17. ASK: ***"Have you seen any signs of giant otter presence?"***
☐ No
☐ Yes (ask for description) ______________________________

____

18. ASK: ***"Have you heard of (other) places where giant otters or their signs have been seen?"***
☐ No (go to 21)
☐ Yes – Location(s) ______________________________

____

19. ASK: ***"Why do you think you have not seen giant otters?"***
☐ Because there never were any (go to 20)
☐ Because there aren't any left (go to 20
☐ Other people have seen them, but I haven't (go to 21)

20. ASK: ***"Why do you think there are no giant otters here?"***
☐ Because they are hunted for food/hunted for their pelts/killed for fun/drowned in nets
☐ Because they don't like people
☐ Because there's no fish
☐ Because there's no space for them
☐ I don't know
☐ Others (please specify) ______________________________

21. **Other observations** (e.g. if cubs are mentioned) If none, conclude interview

____

____

____

THANK YOU

Table for recording several sightings (questions 11-15)

11. Name of location and/or coordinates	**12. Short description of habitat**	**13. Were you on land (√) or on a boat (x)**	**14. Travelling with a motor (√) or without (x)**	**15. Description of otter reaction**

Appendix 6

Claus REUTHER

Geographic Considerations Regarding Otter Surveys

Grid type

The mapping of animal species may be carried out referring to different spatial reference quantities or points. These may be the exact (geographic) points of observations, administrative units (e.g. communities, counties or federal states), river systems, or theoretical (geographic) grids. The latter has become the most used method for large-scale spatial distribution mapping.

Grid systems:
- may form the basis for a uniform (and comparable) coverage of an area,
- are independent of alterations of administrative borders (which can happen with administrative units), and
- usually do not reflect the density of natural features (i.e. water bodies).

Therefore they meet the most important requirements for range-wide distribution mapping:
- they allow the coverage of large spatial areas,
- they ensure a uniform distribution of reference points ('survey sites'), and
- they make it possible to relate the results to comparable spatial units.

For the latter aspect it is of importance to have a grid system which forms uniquely identifiable spatial units. There are various grid systems to divide the earth's surface into spatial units or to specify locations on the surface of the earth. They all have to deal with the fact that the earth has the 'shape of a potato' and that maps usually reflect a one-dimensional, flat earth model. The two most used grid systems are the geographic degree grid (latitude/longitude) and the UTM (Universal Transversal Mercator) grid.

The geographic degree grid refers to the position of the two poles and the position of the equator. The semicircles reaching from pole to pole are called degrees of longitudes or meridians. The circles positioned parallel to the equator are called degrees of latitude or parallels (of latitude). The meridians (longitudes) meet at north and south at one point, the north- or the south-pole. The parallels (latitudes) are spaced equal distances apart parallel to the equator, and are of decreasing size as they approach the north and south. These two circle systems form the basis for the surveying of the earth and for the geographic coordinate system (see Figure 110). Longitudes and latitudes are fixed by international agreements.

There are 360 meridians (each forming a semi-circle). The prime (or zero) meridian is the one passing through Greenwich (UK). From this meridian, degrees of longitude are counted up to 180 to the east (180° east) and to the west (180° west). The 180° meridian is called the international data line. The distance between the meridians is 111 km at the equator. There are 180 parallels (of latitude) (each forming a full circle). The equator forms latitude zero. From the equator, latitudes are counted up to 90 to the north (90° north) and to the south (90° south). The 90th latitudes north and south are the north and south poles respectively. The distance between the latitudes is always 111 km.

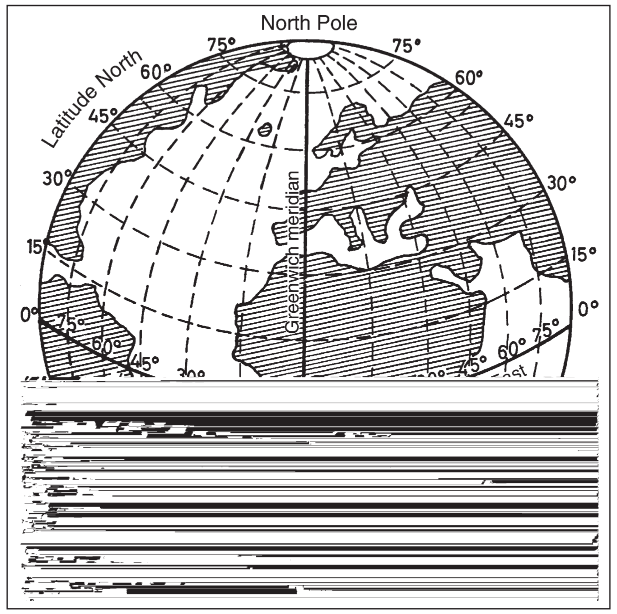


Fig. 110: The world-wide geographic degree grid (REUTHER et al. 2000). (Habitat 12, pg. 94, Fig. 65).

The UTM (Universal Transversal Mercator) grid was adopted by the U.S. Army in 1947 for designating rectangular coordinates on large scale military maps. The UTM grid is imposed on the Mercator projection. UTM divides the earth into 60 zones each 6 degrees of longitude wide. These zones define the reference point for UTM grid coordinates within the zone (see Figure 111). UTM zones extend from latitude 80° S to 84° N. In the polar regions the Universal Polar Stereographic (UPS) system is used. UTM zones are numbered 01 through 60, starting at the international date line, longitude 180°, and proceeding east. Zone 01 extends from 180° W to 174° W and is centred on 177° W. This central longitude line of a zone is called the "central meridian". Each zone is divided into horizontal bands spanning 8 degrees of latitude. These bands are lettered, south to north, beginning at 80° S with the letter C and ending with the letter X at 84° N (the letters I and O are excluded to avoid confusion with the numbers one and zero). The band lettered X spans 12° of latitude. When geo-referencing UTM grid coordinates, the zone to which they refer is also mentioned (e.g. 19L), since the same coordinates will refer to a point in all other zones. The UTM grid can be sub-divided into squares of optional size (e.g. 1x1km, 5x5km, 10x10km, 20x20km, 50x50km, etc.).

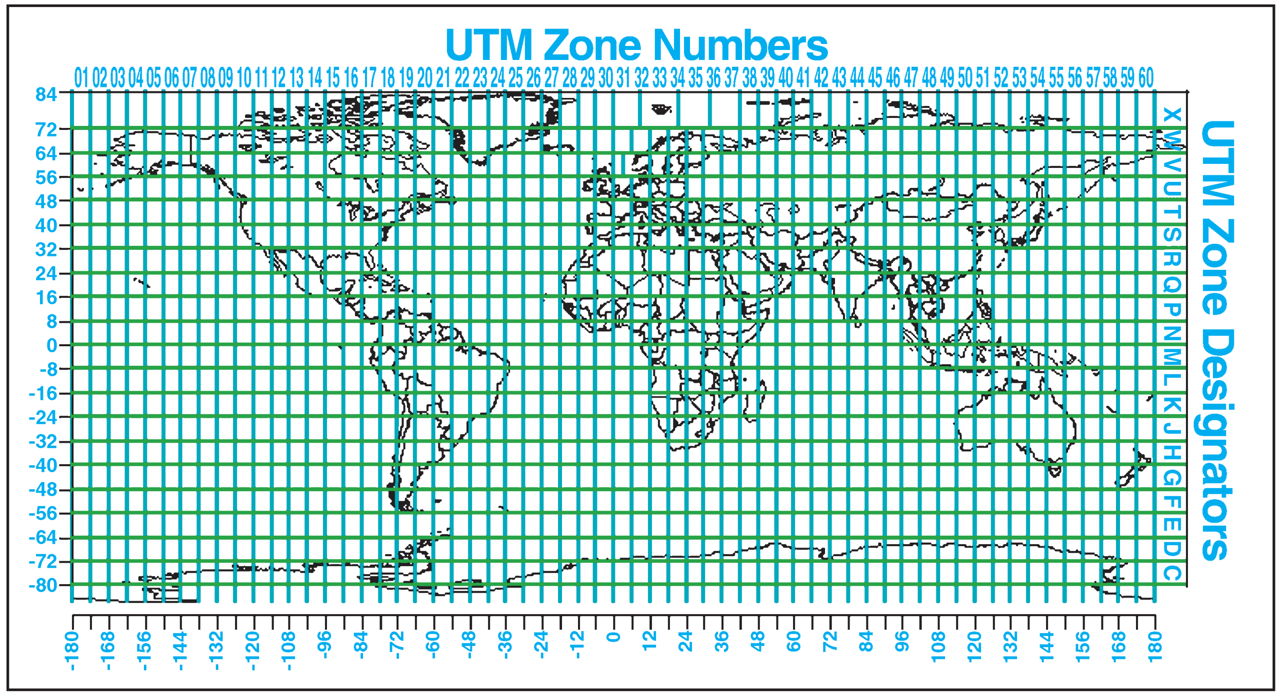


Fig. 111: The Universal Transverse Mercator (UTM) grid (DANA 1999). (Habitat 12, pg. 94, Figure 66).

The main difference between the two systems is that variety in the size of grid units of the geographic degree grid is much greater. The closer units are located to the poles, the smaller they become. In contrast, units of the UTM grid are all the same size (dependent, of course, on the scale selected, i.e. for a 100x100km grid all squares have a size of 10,000 km²) – with the exception of border areas between the different UTM zones. In these border areas, grid units do not have the shape of a square but of a trapezium or triangle, the sizes of which increase with increasing proximity to the equator.

For more information on using the UTM map coordinate system, check **www.maptools.com/UsingUTM/**

Geodetic datum

The earth's shape can be said to be an ellipse (an oval), and ellipsoidal earth models were developed for accurate range and bearing calculations over long distances. Reference ellipsoids are usually determined by the equatorial radius and flattening (the relationship between equatorial and polar radii). However, since the earth does not have a smooth surface, the accuracy of the different ellipsoids at different points of the earth varies. This was the reason why surveyors and cartographers used the respective ellipsoid which offered best accuracy for a specific region, if only a part of the earth's surface had to be mapped. Definition of orientation and position of the ellipsoid with respect to the earth was achieved by a so-called geodetic datum.

The geodetic datum represents the spatial fixation of the centre of a specific ellipsoid. There are over 240 geodetic datums currently in use. Conversions are, in theory, straightforward but need computing. Referencing geodetic coordinates to the wrong datum can result in position errors of hundreds of meters (Dana 2003) (see Figure 112). Therefore, if positions are transferred from one map to another, it is indispensable to be aware of the geodetic datums and ellipsoids for both maps in order to do conversion if necessary. The geodetic datum and ellipsoid are given in the legend of all topographic maps.

To overcome the problems arising from this diversity of national and regional geodetic reference frames, nowadays the 'World Geodetic System 1984 (WGS 84)' is in use in most regions of the world. Most modern maps refer to this geodetic datum and all GPS receivers offer the opportunity to select WGS 84 as a map datum.

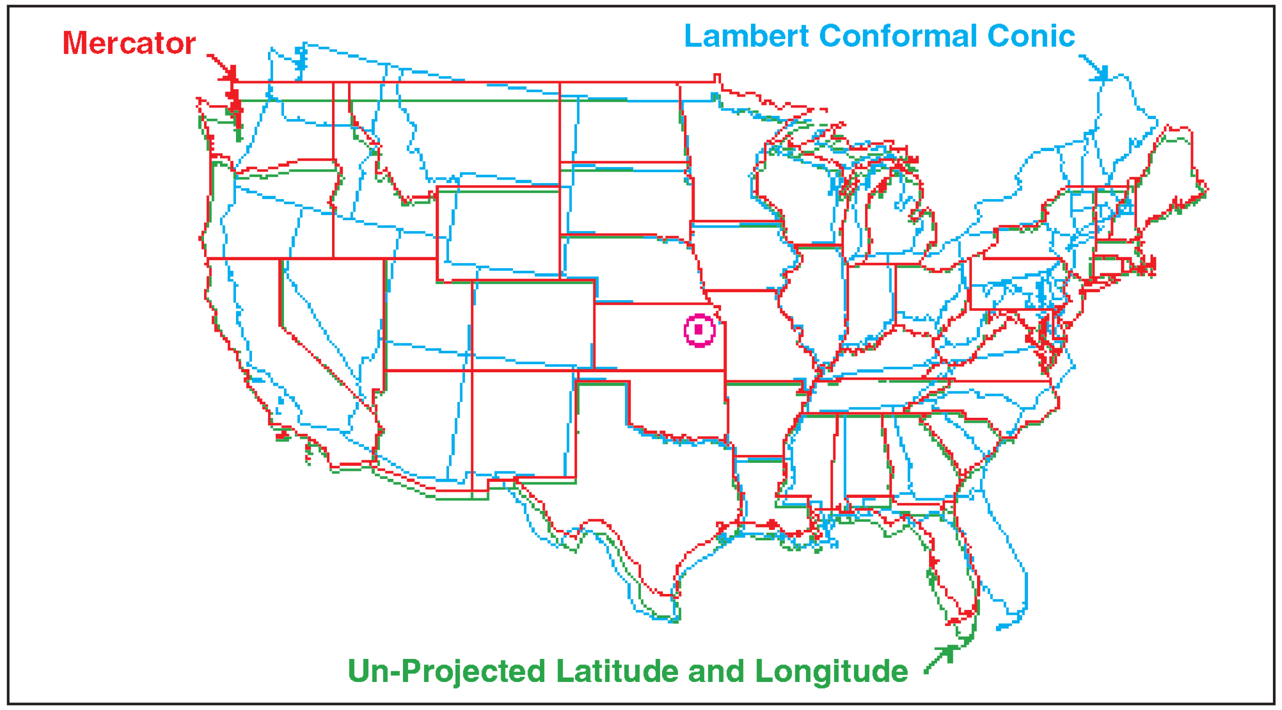


Fig. 112: Divergences resulting from different map projections by the example of three projections of the USA centred at 39 N and 96 W (DANA 2000). (Habitat 12, pg. 92, Figure 64).

Appendix 7

Nicole DUPLAIX

Preliminary Notes on Selecting / Capacitating New Surveyors

Finding and choosing a candidate

In my experience potential students often find you first, via the local university, through other contacts and, recently, via the internet. Sometimes the most unlikely candidates turn out to be the toughest and most dedicated researchers, while others, highly qualified, give up quickly. Appearances and references may be misleading.

Determining the level of interest and experience of the candidate

Many apply but few are chosen based on the first interview. I try to determine the level of knowledge and commitment of the student by asking the following questions.

- Why do you want to study giant otters instead of …?
- What do you know about otters?
- Would you pick up an otter scat and smell it?
- Have you spent time in the field? How long?
- Do you like being wet, muddy, hungry and uncomfortable?
- Do you require special food or medication?

During the interview I look for the following: a real interest in wildlife, a can-do attitude, an open mind about personal discomfort, a willingness to observe and record details, a need to know more and to dig deeper, and a sense of humour. Experience in the field or knowledge of otters are less important than basic character traits.

Briefing the candidate

Describe briefly what the student will be doing with you, what it's like to sit in a boat all day, to get up before dawn and break camp, how often you may or may not see otters. It is important to first underline the reality of field work rather than to immediately explain how an otter survey is conducted and the information that will be collected and how – this can be done much better in the field. If the student is really interested they will ask questions, ask to read background information, and listen. If they say they have done it all – beware.

Once I am convinced that this is a good candidate (and I have been wrong), then I take out the maps, explain the basics of otter ecology and behaviour and hand out key publications and photographs. I also give them a detailed list of what to take in the field and what to leave behind. The day before departure I go over the list again and lend them items they have not been able to find or buy.

In the field

Choosing the first survey site

When I am training a field assistant I try to take them first to a river where I know we will find otter sign and hopefully see otters relatively frequently. I feel it is important to reinforce their enthusiasm for otters with quick results, before the boredom of days spent sitting in the boat seeing little discourages them. You can spend days discussing otter sign and sightings endlessly *after* you have seen them together – it's not the same in the abstract, in anticipation.

Finding otter signs

If you are on a river you know well, you will have an idea where and when you will begin to find campsites. Stop at all campsites, in use and not in use, and go over the area carefully. It is important to point out every detail: tracks, scratch marks, trampled vegetation, scats, urine, fish parts, scent pile and to explain how the otter left each sign. Describe sights, sounds and smells so that the student can visualize what happened and become familiar with them. "Think like an otter, see like an otter, be an otter" is the most important message to give every student.

Explain that ageing a site is not as important as making sure it is a real giant otter site in the first place. Measure and record that first site carefully on a detailed check sheet (which may be more detailed than the one used in a survey later) – this to make sure that the student *sees* every detail and can describe it. The data sheet is filled out at the site by the student, including the GPS position, *before* we move on to the next one. I check it too. I find that students, as they become more familiar with identifying sites, may just be satisfied to scramble ashore, take a quick look, give their opinion and jump back in the boat and this is how mistakes are made. Take the time to re-check the site if you think it necessary.

It is important to make sure that the area surrounding the site is explored thoroughly – the bank above the site for a latrine, back into the forest to check for nearby swamps or pools, upstream and downstream on either side for up to 30m. Sometimes a site 'not recently in use' turns into a 'recently in use' site with a closer inspection of the vicinity.

After the first ten sites or so I begin to ask the student to go ashore alone and make an evaluation. Then I ask them "why", and if need be, double-check myself. This helps build up their confidence.

If there are *Lontra* sites in the area these are inspected as well and all the details are measured and recorded so that they can understand differences between the species (size, difference in smell and consistency of scat are key factors in identification).

Interpreting otter sign

It is not the identification of an otter site that poses the most problems but the interpretation of the sign found. That is the reason we have reduced the interpretation component of the survey to the strict minimum. While you can explain differences in the age of otter sign when you find them, you will need to explain that there are many factors that affect how quickly otter sign ages, dries, washes out. Discourage the student from drawing any conclusion from sign such as: size or identity of group, direction of travel and age of the sign. Underline that a yes or no answer as to whether this is giant otter sign is enough for a distribution survey.

Teaching the student how to use a GPS

Some students pick up the use of a GPS quickly while others simply refuse to do it or use it incorrectly. Using two GPS units side by side at first, helps to make sure that the student understands the functions and is writing down the correct data. Not giving the GPS sufficient time to acquire its satellite locations *before* writing down the reference point is often a source of error.

I usually go through a complete "setup" of the GPS with the student to introduce them to the concept of how/why a GPS works. Once they have acquired the basics, I put the student "in charge" of the GPS…and watch closely. If they are keen to learn they will take the job seriously and look at it often.

One of the most important functions of the GPS is the "Go To" button to re-locate a site quickly as you paddle up and down the river. This saves a lot of time particularly if the site is small or well hidden. It helps too when the bank has collapsed and the site has 'disappeared' after the rainy season. I will ask the student to tell me how far we are from site X by looking at the GPS "Go To".

It is useful to develop a code for all the sites you have entered on the GPS so that you can remember them easily (see Field Techniques). I also write down the positions of all sites that have been stored in the GPS in the data sheets and in my notebook as a backup in case the GPS malfunctions or is lost overboard.

Appendix 8

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