

PRELIMINARY STUDY ON THE ACOUSTIC COMMUNICATION OF CAPTIVE OTTERS (*LUTRALUTRA*)

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ABSTRACT – The study was conducted on captive otters (*Lutra lutra*) in a large enclosure (1.64 ha in area). Data on different kind of sounds related to specific behaviours were recorded by videocamera. Furthermore, sounds were collected by tape recorder, analysed by spectrograph and represented by spectrograms. A general pattern of the vocalizations of otter has been obtained, in order to understand the acoustic communication system of the species. The main sound categories were blows, mewings and cries in an aggressive context, murmurs and two kinds of whistles in a social context.

Key words: *Lutra lutra*, Acoustic communication, Captivity, Behaviour.

RIASSUNTO – *Studio preliminare sulla comunicazione acustica della lontra (Lutra lutra) in cattività.* – Lo studio è stato condotto su lontre (*Lutra lutra*) tenute in cattività in un ampio recinto (1,64 ha). Attraverso riprese effettuate tramite videocamera, sono stati raccolti dati sull'emissione delle diverse tipologie di suoni in determinati contesti comportamentali. Inoltre, per mezzo di un magnetofono sono state registrate alcune manifestazioni sonore, successivamente analizzate mediante sonografo e rappresentate in forma di spettrogrammi. In questo modo è stato ottenuto un quadro della gamma di vocalizzazioni della lontra che può contribuire alla comprensione del suo sistema di comunicazione acustica. Le principali categorie di suoni individuate consistono in sbuffi, miagolii e grida nell'ambito aggressivo, mormorii e due tipi di fischi nell'ambito del contatto sociale.

Parole chiave: *Lutra lutra*, Comunicazione acustica, Cattività, Comportamento.

INTRODUCTION

While chemical signals in mammals act for quite long periods without direct contacts by individuals, acoustic communication needs the contemporaneous presence of sender and addressee individuals. Most carnivores, including the European otter (*Lutra lutra*), are nocturnal and elusive. Interacting individuals are therefore very infrequently encountered and field studies on vocalizations are difficult to carry out. On the other hand, captivity is thought to influence an animal's behaviour (Peters & Wozencraft, 1989). So favourable conditions for research on vocal communication of otter should be provided by a large enclosure, as used in the present study.

Gregarious and social mammal species generally show a more complex system of acoustic communication than solitary species. This also occurs among otters. In fact, Davis (1978) used vocalizations, together with some morphological characters, to divide the Lutrinae subfamily into three tribes of different degrees of sociality. However, Lutrinae vocalizations are not yet well known. Some references on this subject are in Peters & Wozencraft (1989). Works on the sea otter *Enhydra lutris* (Sandegren et al., 1973), on the giant otter

Pteronura brasiliensis (Duplaix, 1980) and on the smooth otter *Lutra perspicillata* (Shanker & Rajendra Madhav, 1991) elucidated some aspects of social behaviour by studying acoustic interactions.

Studies on the vocalizations of the European otter in captivity were carried out by Scheffler (1985), Scheffler & Thaler (1986), and Rogoschik (1987 and 1989). Scheffler and Thaler (1986) collected information on the different kinds of sounds used, and pointed out that some of their acoustic characteristics appear to be an adaptation to the noisy water environment. Rogoschik (1987 and 1989) analysed a large sample of vocalizations and distinguished eight basic types, assigning them as aggressive-noisy, aggressive-tonal and social-tonal sounds; she also studied the ontogeny of otter's calls.

Tab. 1 – Otter sounds according to several authors (* This French term is usually employed to describe a faulty, palatal articulation of the letter S. Considering it as an otter's vocalization, hence, we can translate it as a blow or **hiss**).

AUTHORS	BLOWS AND SNORTS	AGGRESSIVE CRIES	CONTACT MURMURS	WHISTLES	NEW BORN GRIZZLINGS
SCHEFFLER & THALER (1986)		"Keckern" (cry)	"gurren" (coo)	"Fiepen" (whistle)	
ROGOSCHIK (1989)	"Fauchen" (blow) "Schnauben" (snort)	"Keckern" (cry) "Quäken" (lament) "Langgezogener Laut" (long sound) "Quietscher" (scream)	"Muckern" (murmur) "Mucker- Keckern" (murmur-cry)	"Pffiff" (whistle)	"Quimern" (grizzling)
MASON & MACDONALD (1986)	"hah"	"chittering" "scream"		"whistle" "squeak"	"twitter"
BOUCHARDY (1986)	"chuintement" *			"sifflement" (whistle)	"gazouillis" (twitter)
DUPLAIX (1971)	"ha!" "soufflement" (blow)	"cri saccadé" (cry in jerks)" "cri d'attaque" (attack cry)		"sifflement" (whistle)	
WATSON (1978)				squeak	
WAYRE (1989)	"hah"	"chittering noise" "scream"	"whickering"	"squeak"	"chirrup"
GREEN et al. (1984) (courtship)	"huff"	"staccato grunt" "growl" "scream" "chittering" "squeak"	"croon" "purr"	"whistle"	
PETERS & WOZENCRAFT (1989)				"chirp"	

Most other authors give only fragmentary information on otter vocalizations. Duplaix (1971) writes about blows, a "cry in jerks" at times followed by an "attack cry", and a piercing whistle which would be used as a sexual call. Watson (1978, in Mason & Macdonald, 1986) describes calls uttered by a cub while its mother was fishing far away. Green et al. (1984) refer to various sounds uttered during courtship. Bouchardy (1986) mentions a "piercing whistle which persists about one second", a "twitter" of cubs asking for milk, and a "chuintement" expressing threat and fear. Wayre (1989) describes the typical behavioural contexts of whistles, blows, threat and "greeting" sounds.

A general picture of original terms used by different authors to describe otter sounds is shown in Tab. 1. Terms are literally translated and grouped in provisional categories.

The analysis of available data seems actually to elucidate rather clearly some categories of vocalizations performed by the European otter. Aggressive-tonal sounds (cries) are the most varied ones, and consequently the most difficult to compare in different authors. Between aggressive-noisy sounds, Rogoschik (1989) & Duplaix (1982) discriminate two forms. In particular the former mentions:

- a "ha", uttered when something new in the environment is perceived,
- an explosive blow, uttered if the novelty seems to be a danger and followed by an escape towards the water.

Whistles are the most frequently reported sounds, probably also for their acoustic characteristics making them most perceptible; only Mason & Macdonald (1986) discriminate between two sorts: a contact "whistle", used by adults and cubs older than two months, and a "squeak" typical of cubs calling their mother who is far away or moaning for their first disagreeable contact with the water.

The different languages make it difficult to compare the descriptions of authors and suggest that an organized inventory of sound forms of *Lutra lutra* is necessary.

In the present study we collect data on otter vocalizations in a large enclosure (1.64 ha in area) and compare them with available literature.

METHODS

Observations were made throughout 1992-93 at the Otter Breeding Centre of the Ticino Valley Nature Park (see Fumagalli & Prigioni, in this volume). When the research started there were six individuals in the enclosure: a 5 years old male, a 6 years old female, two 15 month old individuals and two 3 month old cubs.

Information on vocalizations was mainly obtained from 30 hours of recorded images using a Sony 8 mm videocamera with monophonic microphone. Such images were extracted from 104 hours of observation carried out in winter, spring and early summer 1993. During filming, 72 vocalizations were recorded. In this way we were able to estimate frequency of utterance of each sound form, knowing when possible the sender individual and the behavioural context.

Vocalizations were also recorded in spring 1992, using a UHER 4000 Report Stereo tape recorder, connected to a Sennheiser MD21N dynamic microphone mounted in an aluminium parabola 60 cm in diameter. Records were obtained at an average distance of 10 m from vocalizing individuals; otters generally remained in the shrub cover or behind it and were not

troubled by our presence. Ground noise was given by far roads, bird calls and sometimes feeble wind. Forty blows, whistles and aggressive mewings and cries were recorded. Some representative sounds were analysed with a Kay DSP 5500 SonaGraph in the 0-16 kHz frequency range to obtain spectrograms.

RESULTS

Otter sounds recorded during observations were classified and related to their behavioural context (Tab. 2), as follows. Each observed situation is represented by an alphabetical letter and described.

Tab. 2 - Vocalization forms and behavioural situations recorded by filming (situations are indicated by alphabetical letters and described in the text; %F. = percentage of frequency; * = heard but not recorded).

SOUND	SITUATIONS	% F (n = 72)	MOTIVATIONAL SIGNIFICANCE
BLOW	<i>a</i> : in water	8.3	hostility, beginning of threat
	<i>b</i> : on ground	5.5	
	tot.	13.8	
MEWING	<i>c</i> : towards other otters	*	carrying on threat
	<i>d</i> : towards the man (juv.)	4.2	
	<i>e</i> : begging for food (juv.)	2.8	
	tot.	7.0	
CRIES: - STACCATO - SCREAM	<i>f</i> : for territoriality	2.8	quarrel
	<i>g</i> : for food	8.3	
	<i>h</i> : meeting an otter	6.9	
	<i>i</i> : playing (juv.)	6.9	
	<i>t</i> : mating (ad.)		
	tot.	24.9	
MURMUR	<i>m</i> : between mother and cubs	2.8	close contact
FEEBLE WHISTLE	<i>n</i> : between cubs	2.8	close contact
LOUD WHISTLE	<i>o</i> : by cubs to their mother	25.0	far contact, moaning
	<i>p</i> : by mother	11.1	
	<i>q</i> : one individual alone (juv.)	9.7	
	<i>r</i> : with aggressive sounds	2.8	
	tot.	48.6	
TWITTER	<i>s</i> : inside the den	*	demanding care by new born

BLOW - The blow is a noisy sound. Frequency is generally between 0-10 kHz, sometimes also reaching higher values. It is reported by several English authors with the onomatopoeic term "hah!", used also referring to other otter species. It seems to be an immediate reaction to the sight of a potential danger. Nevertheless it is not clear if it assumes an alarm or a threat significance. Wayre (1989) supports the former hypothesis. Blows were uttered at irregular intervals, also in long sequences, until the alarm source breaks off or an aggressive behaviour follows. They were very frequent and addressed mainly to human beings.

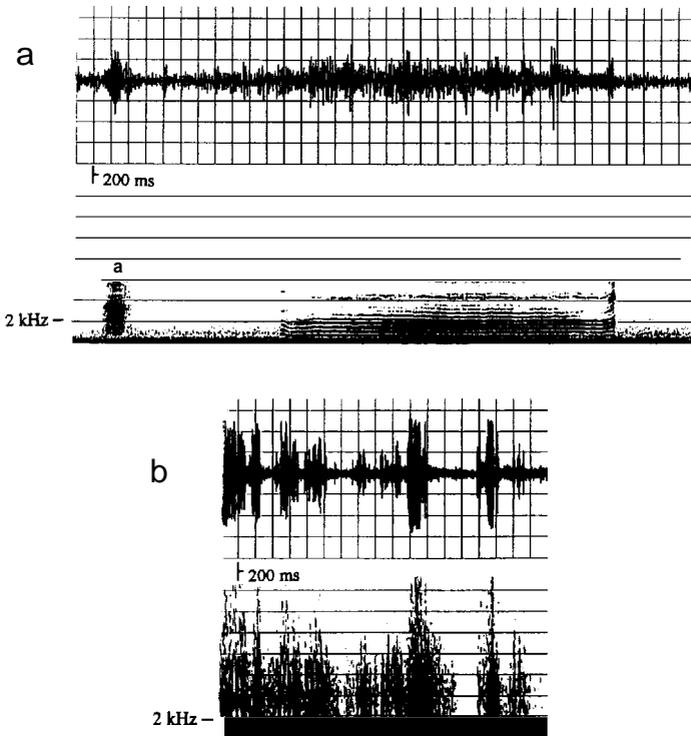


Fig. 1 – (a) Oscillogram and spectrogram of an aggressive sequence: blow followed by a prolonged mewling ending with an increase of pitch (narrow band: 117 Hz, time resolution 52 ms). Time unit = 200 ms, frequency unit = 2 kHz. (b) Oscillogram and spectrogram of a quarrel with aggressive cries. Units as in (a).

- *a*: the animal, while swimming, suddenly notices a man on the edge. At first it often reacts by plunging, but immediately after it emerges and looks around, exploring in the typical periscope-like position, uttering blows every now and then.

- *b*: a similar situation happens when the animal notices a stranger while it is on land, and it looks at it partially hidden in the cover vegetation. In this case the blow is frequently associated to hints of attack and mewlings, especially by juveniles which in general showed a more enterprising behaviour directed to human beings.

MEWING - This is a low frequency and mournful sound, very often prolonged, and it can be repeated many times. It shows a typical regular structure; it lasts **3-4** seconds with constant frequency values, at times with sudden increases just at the beginning or at the end. It was performed especially by juveniles, although Rogoschik (1987) reports many vocalizations by adults too. It expresses a negative interaction at a middle distance (about 2 m), which happens when the animal meets an unwelcome conspecific or a human being. In most cases it signifies threat, and is the overture of an aggressive sequence. It can evolve to higher frequency cries. On the other hand, mewling can be alternated with blows or loud whistles. Fig. 1a shows

a typical mewling following a blow: these sounds were uttered during a threat sequence directed to man.

- *c*: directed to a conspecific met during ground displacements.
- *d*: directed to a man obstructing the passage.
- *e*: directed to a man when the animal is waiting for food; its vocalizations can attract other individuals, which also start vocalizing.

CRIES - Aggressive cries assume different forms, showing a certain variability; we can essentially distinguish two kinds of cries: one constituted by a succession of short "staccato" sounds, in some aspects similar to the contact murmur, and the other represented by an higher and prolonged scream. The first type can evolve to the second one or break off; both can be preceded by the threatening mewling. Aggressive cries recorded during a quarrel have a very irregular shape, and reach frequencies higher than 16 kHz. Cries were always uttered towards one or more conspecifics which were nearby (less than 1 m), or during a physical contact. Fig. 1 shows aggressive cries performed during a quarrel between two individuals.

- *f*: during aggressive quarrels "for the territory". For example, when the older male passes through an enclosure's area especially frequented by juveniles, a quarrel can arise: it can be associated with vocalizations and simulated attacks, or even brief physical contacts.

- *g*: during aggressive quarrels for food, especially that provided by man (fish, poultry). This happens both when food is received by animals and when it is stolen and consumed.

- *h*: during aggressive protests in every situation where the conspecifics' closeness causes a general annoyance.

- *i*: during playing, mostly between cubs, e.g. as a reaction to a painful aggression.

- *l*: during mating behaviour. No details are available, because we could not film this situation.

MURMUR - This is a low sound, similar to a coo, which occurs when animals are in closed contact. It could assume a reassuring or a greeting function. This kind of sound is difficult to perceive, both for its acoustic characteristics and for the context in which it happens (on ground, especially when animals are hidden under the vegetation). It has been recorded on just two occasions.

- *m*: mother and cubs meet all together after a short separation.

FEEBLE WHISTLE - The majority of authors talk about whistles in general but we distinguish two forms, as Mason & Macdonald (1986) have done. The one they indicate as "whistle" seems to correspond to the shortest and feeblest we recorded: it is used as a contact sound between close individuals which are signalling their presence to each other. This call has been recorded more rarely than the loud whistle; however it is not easily audible.

- *n*: two cubs are close on the ground, while their mother is far away; they call each other at intervals of about 1 s, many times.

LOUD WHISTLE - The "squeak" reported by Mason & Macdonald (1986) would correspond to this sound, which is similar to a whine. This is different from the feeble whistle for it is stronger and a little bit longer. It acts as a distance call. Generally speaking it can be considered as an expression of an uneasiness, due to several reasons (e.g. the cubs moan at the distance of their mother). The spectrograms of such whistles show a typical peak-like harmonic structure and the frequency generally varies between 5-7 kHz.

- *a, p*: the cubs call the female which is far away. Usually she does not answer, sometimes instead she approaches again, in case uttering herself a similar whistle. This context is the most frequent one among those where vocalizations were recorded.

- *q*: sometimes an individual, usually a juvenile, whistles without close conspecifics, expressing uneasiness, probably due to hunger or to bad physical condition (for a certain period a juvenile was debilitated and sometimes uttered such sound).

- *r*: whistles alternated with aggressive sounds (mewing or cries) are uttered towards other close individuals: a juvenile towards the oldest male and a cub playing together.

TWITTER - No twitter was recorded, since this sound is performed only by newborn cubs towards their mother inside the den. However it is well known by studies in strict captivity.

DISCUSSION

In our large enclosure the animals have shown a quite natural behaviour, including intraspecific acoustic communication. Such condition allows to carry out observations about the relationship between vocalizations and behaviour. On the other hand, a large area involves several problems to obtain good records and spectrograms. This work is at a descriptive and schematic level, and more objective research needs precise measures and statistical evaluation, as Rogoschik (1987) did on strictly captive animals.

The vocabulary of the species at present appears quite clear, even if more precise distinctions could be made. In addition, correlations between acoustic characteristics and sex and age parameters could be done. Our observations confirm that the European otter has a considerable number of basic sound forms and their variants. The bibliographical data on this subject are scarce, however, because it is difficult to detect animals in nature, and not because the otter is a "silent species" due to its solitary habits.

The vocabulary of *Lutra lutra* can be compared with that of *Pteronura brasiliensis* (Duplaix, 1980). Even though the giant otter shows a very different social system, it shows some affinities with the European otter: several kinds of vocalisations, e.g. blows and murmurs, are used in similar behavioural contexts. This agrees with the results of cladistic analysis by van Zyll de Jong (1987) who includes both species in the same phylogenetic group.

The success of playback experiments on *Lutra perspicillata* (Shanker & Rajendra Madhav, 1991) suggests that this method could be useful to study otters

communication systems. Playback experiments in captivity may allow the selection of sounds that could be used in field censuses of the species.

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