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(1.   210095; 2.   810001)

: 2005   2010   6—8   。

(42.02±2.22)% (31.21±2.71)%   、   3   。   1—10   12

3   。

、   3   。

3   8:00—8:59 10:00—12:59   16:00—19:59;   ;

1   14:00—14:59。5   。

:   ;   ;   ;   ;

Behavioural time budgets and diurnal rhythms of the female Tibetan gazelles in the Kekexili National Nature Reserve

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Abstract: Optimal time budget for behaviours may be constrained by intrinsic and extrinsic factors forcing animals to balance their daily energetic needs. From June to August in 2005 and 2010 the behavioural time budget and diurnal rhythm of the female Tibetan gazelles *Procapra picticaudata* were studied by focal animal sampling along the Qinghai-Tibet Highway (QTH) in the Kekexili National Nature Reserve. We restricted the sampling within 200 m from the QTH. In the end a total of 255 observation units were collected. All behaviours were divided into five categories Foraging Vigilance Lying Moving and Other and there was a significant difference among them using the Kruskal-Wallis H test ($P<0.001$). Foraging and resting accounting for $(42.02±2.22)\%$ and $(31.21±2.71)\%$ respectively were the two main behaviours of the gazelles. This might relate to the low aboveground biomass 36.49—63.85 g/m^2. The gazelles should spend more time foraging to obtain more nutrition. Moreover as rumination indicates more lying could assist in allowing the food to digest and thus nutrient assimilation. The groups of the Tibetan gazelles comprised from one to 12 individuals but the groups with 11 animals were absent in this study. Analysis results of the Spearman rank correlations showed that with the increase of group size the gazelles increased time foraging ($P<0.05$) and decreased time vigilance ($P<0.001$) which were due to the combination of the dilution hypothesis and the detection hypothesis. Theoretically lactation carried a high energetic cost and the lambs were vulnerable to the predators wolves and raptors. The gazelles with

a lamb (mothers) were supposed to increase their time on foraging and vigilance comparing with the individuals without a lamb (female). However results of the Mann-Whitney U tests suggested that there were no significant differences in foraging vigilance and other between females and mothers however the mothers devoted more time to moving ($P<0.01$) and less time to lying ($P<0.05$) than those of females without a lamb. Increasing moving could not only allow them to find new food resources easily but also avoid the predation risk in time so the moving behaviour could play the role of vigilance to a certain extent. The peaks of foraging were recorded at 8:00—8:59 10:00—12:59 and 16:00—19:59 which were staggered with the foraging peaks of Tibetan antelopes inhabiting the same area. Temporal niche division could explain the coexistence of sympatric ungulates. The trend of lying was opposite to that of foraging owing to the trade-off among behaviours. Similar lying-foraging-lying transformation could be shown in many other ungulates. The only peak of vigilance occurred at 14:00—14:59 which could be explained by the variation of traffic flow on the QTH. The QTH plays an important role in Tibetan economic development and transports in 85% of imports and about 90% of exports from the Tibetan Autonomous Region. There was a significant trend of traffic flow and the peak which occurred during 12:00—15:00. According to the risk-disturbance hypothesis the Tibetan gazelles would express high vigilance level with the high human distance i.e. the high traffic flow. The Kruskal-Wallis H tests indicated that the five behavioural categories showed significant variance among the periods of diurnal time ($P<0.05$).

Key Words: Tibetan gazelle (*Procapra picticaudata*); behavioural time budget; group size; reproduction status; diurnal behavioural rhythm

:   (、   、   、

)   (、   、   )[1-3] 。

          [4-5] ;   [6-7]

          [8-9] 。   。

          [10] 。

          (*Procapra picticaudata*)   、

          [11] 。

[12-13]   Ⅱ   。   [12 14] 、   [15] 、   [16]

[17]   [18] 。

          。2005

2010   6—8

          。

1

1.1

          K2970(93°25′ E 35°21′ N)—   (93°05′ E 35°14′ N)   (1)。

          4 620 m

          −5.6℃   (23.2℃)   (−23.7℃)   7

1   5.4℃ −16.9℃。6—8   (265.8 mm) 69%。

          4.8 m/s   6.4 m/s[19]。

          (*Pantholops hodgsonii*)、   (*Equus kiang*)、

(*Poephagus grunniens*)、 (*Canis lupus*)、   (*Ursus arctos*)   (*Vulpes ferrilata*)
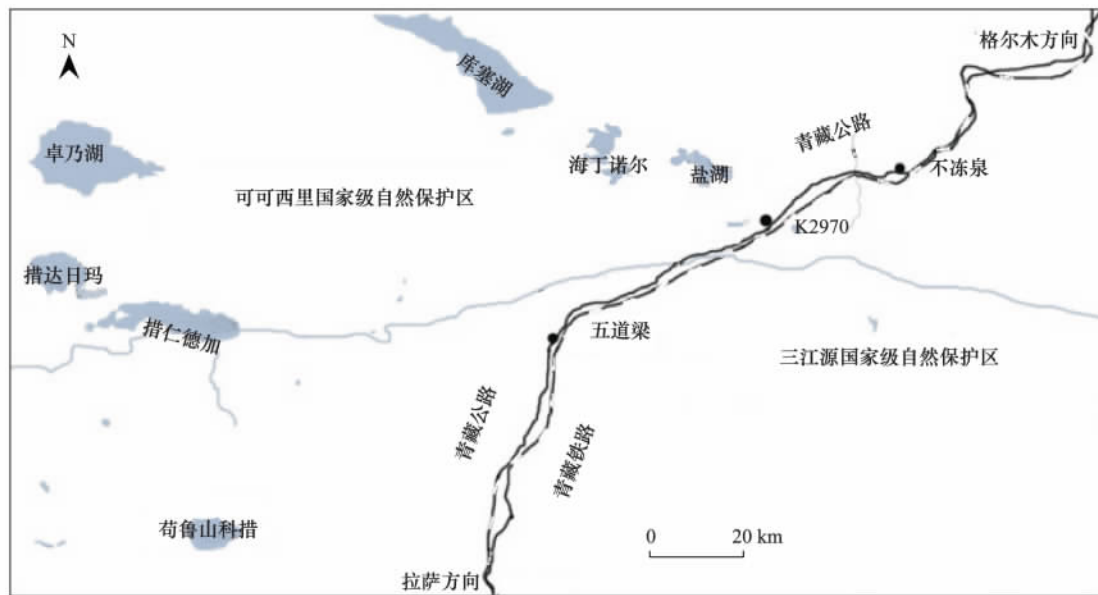
http://www.ecologica.cn

1

Fig. 1 Map of study area. The study was conducted between K2970 and Wudaoliang along the Qinghai-Tibet Highway the Kekexili National Nature Reserve Qinghai Province

[11-12] 。 (*Stipa purpurea*) 、

(*Carex moorcroftii*) 、 (*Littiedalea racemosa*) 、 (*Oxytropis microphylla*) 、 (*Oxytropis glacialis*) 、 (*Pleurospermum hedinii*) (*Androsace tapete*) [20] 。

1.2

2005 2010 6—8

8：00—20：00 [19] 10×70 Newsmy

： 、 、 、 、 。

WCJ-2((6 000±1) m) 。

200 m 。 10 m

。

。

4—15 min 12.9 min。 1—3

。 5 ： 、 、 、

。

; ; ;

; ： 、

、 、 、 。 8

255 。

Noldus Observer XT 5

(/min) (/)。 IBM SPSS statistics

19.0 。 2005 2010 5

。 Kruskal-Wallis *H*

Spearman 、 。 Mann-Whitney *U*

。 *P*<0.05 。 ±1

http: //www.ecologica.cn

。

2

2.1

2

(42.02±2.22)% (Mean±SE;) 4

: (31.21±2.71)%、 (16.36±
1.44)%、 (8.31±0.74)% (2.05±0.32)%。
Kruskal-Wallis H 5
($x^2 = 198.866$ d$f = 4$ $P <$
0.001)。

2.1.1

12

11 。Kruskal-Wallis H 5
($P <$
0.01)。Spearman

($P < 0.05$)
($P < 0.001$ 3); 3

。

2

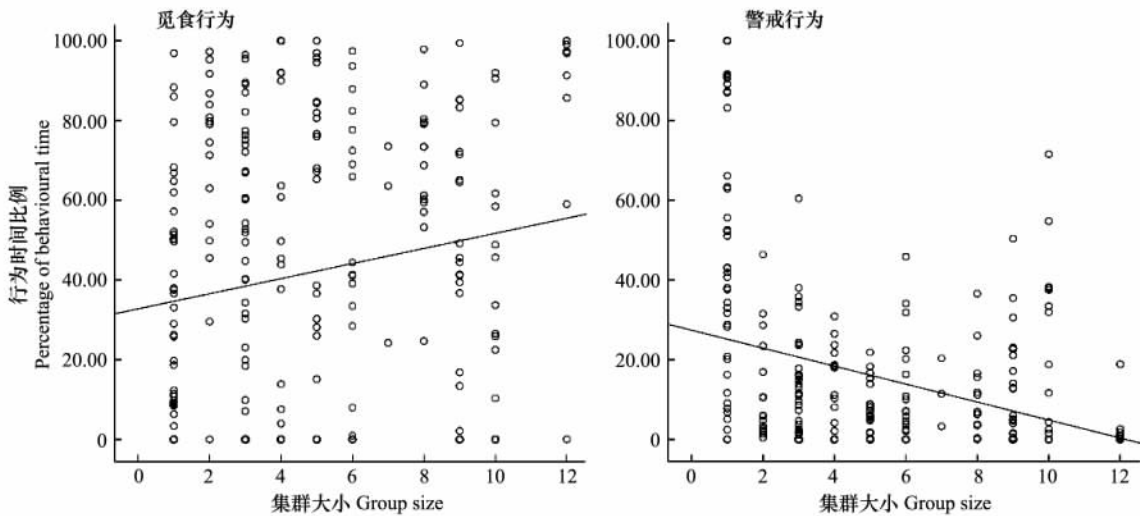Fig. 2 Behavioural time budget of Tibetan gazelles in the Kekexili National Nature Reserve

3

Fig. 3 Effects of group size on foraging and vigilance in Tibetan gazelles in the Kekexili National Nature Reserve

2.1.2

Mann-Whitney U (4)
($P < 0.05$) ($P < 0.01$) 、 3
($P > 0.05$)。

2.2

8:00—19:59 5 。 8:00—8:59
10:00—12:59 2 16:00 19:59。
。 11:00 14:00—14:59
。Kruskal-Wallis H 5 ($P < 0.05$)。

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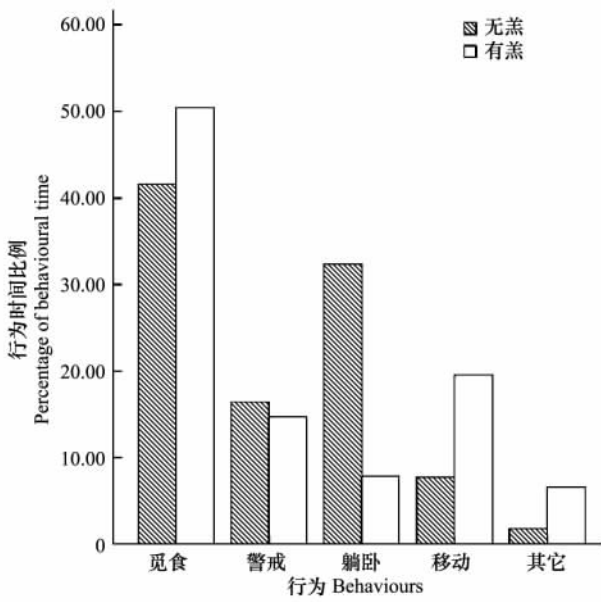
Fig. 4   Effects of reproduction status on Tibetan gazelle in the Kekexili National Nature Reserve

5
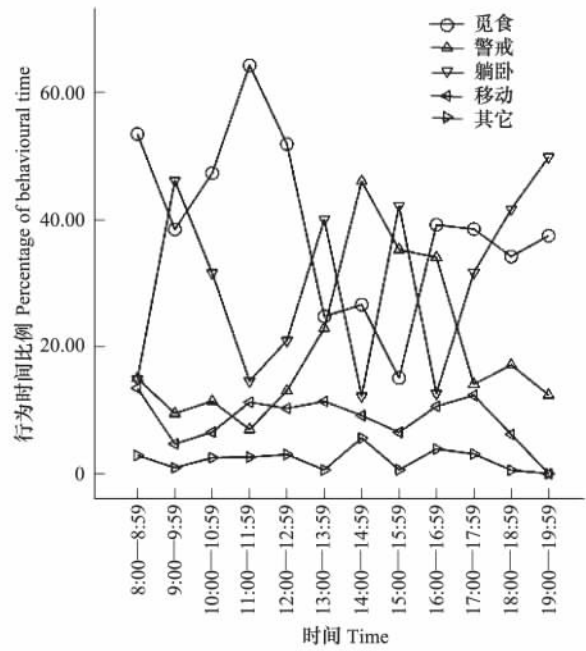
Fig. 5   Diurnal behavioural rhythms of Tibetan gazelles in the Kekexili National Nature Reserve

3

3.1

（*Cervus elaphus*）　　（*Odocoileus virginianus*）　　50%

（*Tragelaphus strepsiceros*）　　63%

（42.02±2.22）%　　　　、　、

59.12%[24]

604[25]。

[27]

[16]　　　　　　　　　　　　　　　　　　　　　　　　（62.59%）

（12.21%）

36.49—63.85 g/m²　　　20%—40%

[29]

[11]

17[30]

http://www.ecologica.cn

1—10 12

31–32

33 ;

34

(*Buteo hemillasius*) (*Aegypius monachus*)

28 35

24

3.2

`、 、 、 、`

37

38

39–40 3 10:00—12:59

24

16

21 " — — "

(*Ovis ammon*) [41] 、 (*Cervus albirostris*) [42] 、 (*Pseudois schaeferi*) [43-44]

12:00—12:59

85% 90%

260km

12:00—15:00

" — " 45

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