EAZA Charadriiformes Taxon Advisory Group

Best Practice Guidelines

Common Redshank

(*Tringus totanus*)

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EAZA

EAZA Best Practice Guidelines for the common redshank (*Tringus totanus*)

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Front cover photo, mating common redshanks, photo courtesy of: R. van Weeren

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Preamble

Right from the very beginning it has been the concern of EAZA and the EEPs to encourage and promote the highest possible standards for husbandry of zoo and aquarium animals. For this reason, quite early on, EAZA developed the “Minimum Standards for the Accommodation and Care of Animals in Zoos and Aquaria”. These standards lay down general principles of animal keeping, to which the members of EAZA feel themselves committed. Above and beyond this, some countries have defined regulatory minimum standards for the keeping of individual species regarding the size and furnishings of enclosures etc., which, according to the opinion of authors, should definitely be fulfilled before allowing such animals to be kept within the area of the jurisdiction of those countries. These minimum standards are intended to determine the borderline of acceptable animal welfare. It is not permitted to fall short of these standards. How difficult it is to determine the standards, however, can be seen in the fact that minimum standards vary from country to country.

Above and beyond this, specialists of the EEPs and TAGs have undertaken the considerable task of laying down guidelines for keeping individual animal species. Whilst some aspects of husbandry reported in the guidelines will define minimum standards, in general, these guidelines are not to be understood as minimum requirements; they represent best practice. As such the EAZA Best Practice Guidelines for keeping animals intend rather to describe the desirable design of enclosures and prerequisites for animal keeping that are, according to the present state of knowledge, considered as being optimal for each species. They intend above all to indicate how enclosures should be designed and what conditions should be fulfilled for the optimal care of individual species.

Summary

The common redshank (*Tringa totanus*) is a small wader native to Europe, Asia, and Africa and a member of the order Charadriiformes. Although classified as Least Concern by the International Union for Conservation of Nature (IUCN) Red List, the species remains relatively uncommon in zoos, making captive breeding and husbandry knowledge limited.

The aim of these Best Practice Guidelines is to provide a valuable resource for zoos currently housing common redshanks, enhancing their care and welfare. This guidance benefits not only the common redshank but also other similar wader species managed within EAZA institutions. By promoting the species and encouraging more institutions to develop expertise in wader husbandry— including hand-rearing techniques—the EEP seeks to establish a foundation of knowledge. This expertise can support more complex conservation initiatives in the future, such as head-starting programs and the conservation of other wader species.

Section 1: Biology and Field Data

This section compiles current knowledge on the species' biology, including conservation status, habitat, feeding behaviour, and reproduction. The information is drawn from published literature as well as field observations.

Section 2: Management in Zoos and Aquariums

This section presents best practices for managing common redshanks in captivity, based on the experiences of institutions that have successfully bred the species. The recommendations are informed by semi-structured interviews with experienced holders, and we extend our gratitude to ARTIS Amsterdam Royal Zoo, Rheine Zoo, Dresden Zoo, Wasit Wetland Centre part of Arabia's Wildlife Centre group, and WWT Slimbridge for sharing their insights.

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Contents

Section 1: Biology and field data 7
1.1 Taxonomy 7
1.2 Morphology 7
1.3 Physiology 10
1.4 Longevity 10
1.5 Conservation status/ Zoogeography/ Ecology 10
1.6 Diet and feeding behaviour 12
1.7 Reproduction 12
1.8 Behaviour 13
Section 2: Management in Zoos and Aquariums 17
2.1 Enclosure 17
2.1.1 Outdoor enclosure 17
2.1.2 Indoor enclosure 20
2.1.3 Boundary 20
2.1.4 Pest control 21
2.1.5 Substrate 22
2.1.6 Furnishing and maintenance 22
2.1.7 Environment 25
2.1.8 Dimensions 26
2.2 Feeding 26
2.2.1 Basic Diet 26
2.2.2 Special Dietary Requirements 26
2.2.3 Method of Feeding 27
2.2.4 Water 28
2.3 Social structure 29
2.3.1 Basic Social Structure 29
2.3.2 Changing Group Structure 29
2.3.3 Sharing Enclosure with Other Species 30
2.4 Breeding 31
2.4.1 Mating 31
2.4.2 Egg Laying, Incubation and Hatching 31
2.4.3 Development and Care of Young 33
2.4.4 Hand-Rearing 35
2.4.5 Population management 39
2.4.6 Behavioural enrichment 39

2.5 Handling 39
2.5.1 Individual Identification and Sexing 39
2.5.2 General Handling 40
2.5.3 Catching/Restraining 40
2.5.4 Transportation 42
2.5.5 Safety 43
2.6 Veterinary considerations for health and welfare 43
2.6.1 Specific problems 45
2.7 Recommended research 45
Section 3: References 46
Appendix I Plant lists 49
Appendix II Diets 52

Section 1: Biology and field data

Biology

1.1 Taxonomy

Order: Charadriiformes
Family: Scolopacidae
Genus: Tringa
Scientific name: *Tringa totanus* (Linnaeus, 1758)
Common name: Redshank or Common Redshank

Six subspecies are recognized (Del Hoyo et al., 1996):

T. t. robusta (Schiøler, 1919) – breeds in Iceland and the Faroe Islands; non-breeding around the British Isles and west Europe

T. t. totanus (Linnaeus, 1758) – breeds in west, north Europe to west Siberia; winters in Africa, India and Indonesia

T. t. ussuriensis (Buturlin, 1934) – breeds in southern Siberia, Mongolia and east Asia; non-breeding in Africa, India and southeast Asia

T. t. terrignotae (Meinertzhagen, R. & Meinertzhagen, A., 1926) – breeds in southern Manchuria and eastern China; non-breeding in east and southeast Asia

T. t. craggi (Hale, 197) – breeds in northwest China; non-breeding in east and southeast Asia

T. t. eurhina (Oberholser, 1900) – breeds in Tajikistan, north India, Tibet and the Malay Peninsula

1.2 Morphology

Common redshanks in breeding plumage are a marbled brown colour, slightly lighter below (figure 1). In non-breeding plumage they become somewhat lighter-toned and less patterned, being rather plain greyish brown above and whitish below (figure 2). They have red legs and a black-tipped red bill and show white up the back and on the wings in flight. Females often have paler upperparts than males, which is more prevalent in *t. totanus*. The different sub-species generally vary only in small details of plumage and size. The common redshank is between 27-29 cm, approximately 85-155 g, and has a wingspan between 59-66 cm (Del Hoyo et al., 1996).

Data from the British Trust for Ornithology (BTO) on biometrics can be found below (British Trust for Ornithology [BTO], 2023):

Wing Length	Adults	Average	169.8 mm ±5.2	Range	161–178 mm	N=10350
	Juveniles	Average	167.5 mm ±5.4	Range	158-175 mm	N=5879
Body Weight	Adults	Average	153 g ±17.58	Range	126–184 g	N=9959
	Juveniles	Average	142 g ±14.3194	Range	120–166 g	N=5503

Eggs have a light green colour with light brown to black dots spread all over the shell (figure 3).

Egg Size: 45×31 mm

Egg Weight: 22.3 g (of which 5% is shell)

Clutch Size: 4 eggs | 3.87 ± 0.43 (2–5) N=905

Figure 1. Common redshank in breeding plumage at Rheine Zoo, photo courtesy of N. Brüning.

Figure 2. Common redshank in non-breeding plumage at Rheine Zoo, photo courtesy of K. Groot.

Figure 3. Egg of a common redshank, pattern can differ per egg. Photo courtesy of R. Castaing.

1.3 Physiology

Exact information for common redshank is not available. Poultry have a body temperature between 40.5°C - 42°C, heart rate of 200 – 400 beats per minute and respiratory rate of 15 – 30 breaths per minute.

1.4 Longevity

Data from the British Trust for Ornithology on longevity can be found below (British Trust for Ornithology [BTO], 2023):

Maximum Age from Ringing:	20 years 1 months 15 days (set in 2007)
Typical Lifespan:	4 years with breeding typically at 1 year
Adult Survival:	0.74 ± 0.014 per year
Juvenile Survival:	0.43 (in first year)

In human care, common redshank longevity typically ranges from 10 to 15 years, with some records of birds living up to 25 years (ZIMS, n.d.).

Field data

1.5 Conservation status/ Zoogeography/ Ecology

The common redshank is a widespread breeding bird across temperate Eurasia. It is a migratory species, wintering on coasts around the Mediterranean, on the Atlantic coast of Europe from Ireland and Great Britain southwards, and in South Asia (Del Hoyo et al., 1996) (figure 4). They are uncommon vagrants outside these areas.

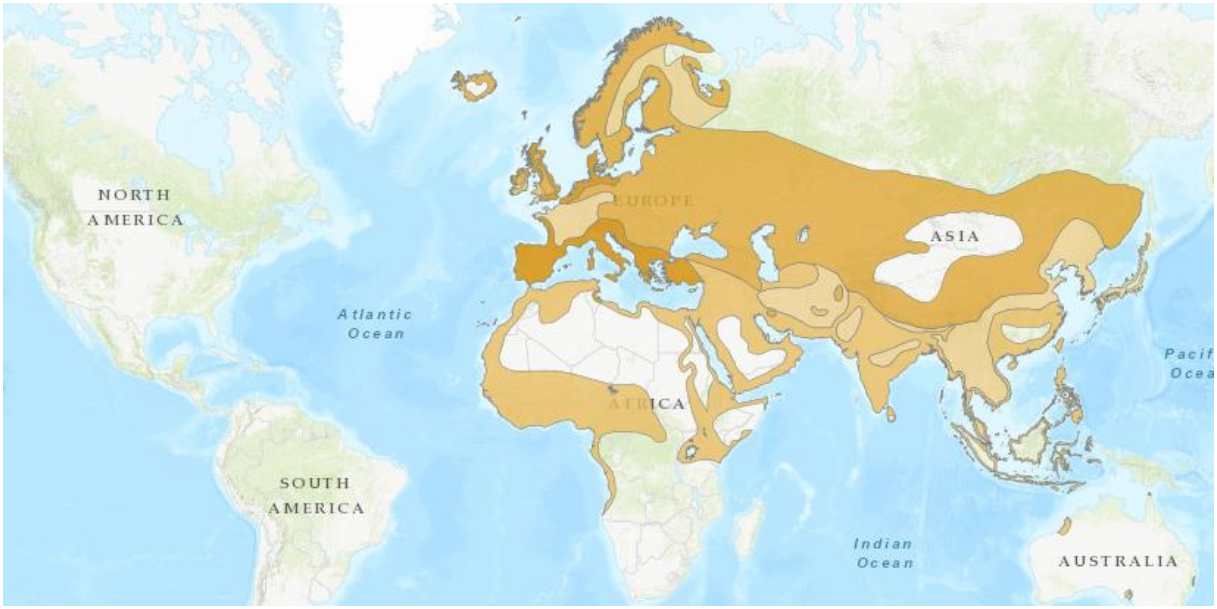

Figure 4. Distribution of common redshank, including subspecies, photo courtesy of the IUCN Red List.

The global population is estimated to number c.1,300,000-3,100,000 individuals (Wetlands International, 2015). The European population is estimated at 340,000-484,000 pairs, which equates

to 680,000-968,000 mature individuals (BirdLife International, 2015). National population estimates include: < c.10,000 individuals on migration and c.1,000-10,000 wintering individuals in China; c.1,000-10,000 individuals on migration and c.1,000-10,000 wintering individuals in Taiwan; c.50-10,000 wintering individuals in Korea; c.100-10,000 breeding pairs and c.50-1,000 individuals on migration and c.1,000-10,000 wintering individuals in Japan and c.100-10,000 breeding pairs and c.50-1,000 individuals on migration in Russia (Brazil, 2009). The population is therefore placed in the band 1,000,000-3,499,999 individuals (BirdLife International, 2016).

The overall population trend is uncertain, as some populations are decreasing, while others are stable, increasing or have unknown trends (Wetlands International 2015). In Europe, trends between 1980 and 2013 show that populations have undergone a moderate decline ($p<0.01$) (BirdLife International, 2016).

Breeding: The species breeds on coastal saltmarshes, inland wet grasslands with short swards (del Hoyo et al. 1996) (including cultivated meadows) (Johnsgard, 1981), grassy marshes, swampy heathlands (del Hoyo et al., 1996) and swampy moors (Johnsgard, 1981).

Non-breeding: On passage, the species may frequent inland flooded grasslands (del Hoyo et al., 1996) and the silty shores of rivers and lakes (Flint et al. 1984), but during the winter it is largely coastal (del Hoyo et al., 1996), occupying rocky, muddy and sandy beaches, saltmarshes, tidal mudflats, saline and freshwater coastal lagoons (del Hoyo et al., 1996), tidal estuaries (Johnsgard, 1981), saltworks, and sewage farms (del Hoyo et al., 1996).

The species is currently listed as Least Concern on the IUCN Red List of Threatened Species (BirdLife International, 2016) . Nonetheless, the species is locally threatened by the loss of breeding and wintering habitats through agricultural intensification, wetland drainage, flood control, afforestation, land reclamation, industrial development (del Hoyo et al., 1996), encroachment of *Spartina* grass spp. on mudflats (BirdLife International, 2016; del Hoyo et al., 1996), improvement of marginal grasslands (del Hoyo et al., 1996) (e.g. by drainage, inorganic fertilizing and re-seeding) (Baines, 1988), coastal barrage construction (Burton et al., 2006), and heavy grazing (e.g. of saltmarshes) (Norris et al., 1998). The species is also threatened by disturbance on intertidal mudflats from construction work (UK) (Burton et al., 2002) and foot-traffic on footpaths (Burton et al., 2002). It is vulnerable to severe cold periods on its Western European wintering grounds (del Hoyo et al., 1996) and suffers from nest predation by introduced predators (e.g. European *hedgehog Erinaceus europaeus*) on some islands (Jackson, 2001). The species is also susceptible to avian influenza, so may be threatened by future outbreaks of the virus (Melville & Shortridge 2006).

CONSERVATION ACTIONS

Conservation Actions Underway

The following information refers to the species' European range only: The species is listed on Annex II (B) of the EU Birds Directive. Due to its unfavourable conservation status, the EU commissioned a Management Plan for this huntable species (BirdLife International, 2016).

Conservation Actions Proposed

The following information refers to the species' European range only: Optimal breeding conditions for this species may be provided by creating a mosaic of unflooded grassland, winter-flooded grassland and shallow pools (Ausden et al., 2005). Winter flooding of grasslands is beneficial to the species as it helps to keep the sward height short and open and creates pools which provide a source of aquatic invertebrates in the spring (Ausden et al., 2003, Olsen & Schmidt 2004). Such shallow pools on coastal

grazing marshes should be maintained until the end of June (Ausden et al., 2003). The number of breeding pairs on improved grassland was successfully increased on a reserve in Wales by the implementation of a two-year rotation of chisel ploughing, as well as a seasonal sheep and cattle grazing regime and a controlled increase in the water-level (Squires & Allcorn, 2006). At Lower Lough Erne in Northern Ireland, the breeding population of the species increased considerably as a result of cutting rush beds in mid-winter (although the species nested on uncut areas, chicks benefited from the presence of adjacent short, open areas for feeding) (Robson & Allcorn, 2006). Low-level grazing of salt marshes (e.g. c. 1 cow per hectare) does not appear to affect the species and may even be beneficial to breeding populations (Norris et al., 1997; Ausden et al., 2005), although cattle should not be put onto the marsh until towards the end of the nesting season (e.g. late May or early June) to minimise the risk of nest trampling (Norris et al., 1997). There is also evidence that too-heavy grazing can be detrimental (BirdLife International, 2016). The species is known to show increased hatching success when ground predators have been excluded by erecting protective fences around nesting areas (Jackson, 2001), and in the U.K. there is evidence that the removal of *Spartina anglica* from tidal mudflats using an herbicide is beneficial for the species (BirdLife International, 2016).

1.6 Diet and feeding behaviour

When breeding, its diet consists of insects, spiders, and annelid worms (del Hoyo et al., 1996). During the non-breeding season, the species takes insects, spiders, and annelid worms (del Hoyo et al., 1996), as well as molluscs, crustaceans (especially amphipods e.g. *Corophium* spp.) (del Hoyo et al., 1996) and occasionally small fish and tadpoles (del Hoyo et al., 1996). Like the diet, the feeding method also varies; the species uses a typical brisk walk while pecking; occasionally probes, jabs or sweeps their bill through water, most of the time it wades through shallow water, but it also occasionally wades, depending on food availability and water levels which vary seasonally.

The species often wades and occasionally swims. When feeding on fish, may forage socially in dense flocks, often mixed with other *tringines*: birds move erratically while pecking at prey or running synchronously in one direction, ploughing or scything bills through water. Feeds both diurnally and nocturnally, mostly in small flocks, occasionally many hundreds, sometimes singly. The species may defend its feeding territory against conspecifics (del Hoyo et al., 1996).

1.7 Reproduction

Common redshanks are sexually mature within 1-2 years and are monogamous (del Hoyo et al., 1996). The breeding season spans from April to June. The nest is a shallow scrape or hollow (BirdLife International, 2016) on a hummock or at the base of a tuft of grass ,often well hidden by overhanging leaves (del Hoyo et al., 1996). The species usually nests solitarily inland (fewer than 10 pairs/km^2) but in loosely colonial groups (up to 100-300 pairs/km^2) on the coast (del Hoyo et al., 1996; BirdLife International, 2016).

Incubation is typically between 23 and 24 days, and both sexes incubate the eggs. The clutch typically consists of 4 eggs (3-5), with a mean laying interval of 38 hours (35-43), it is observed that pairs can lay replacement clutches if needed (del Hoyo et al., 1996). Eggs have a light green colour with light brown to black dots spread all over the shell. Hatching success is c. 14% in the wild (del Hoyo et al., 1996).

Data from the British Trust for Ornithology on egg metrics can be found below (British Trust for Ornithology [BTO], 2023):

Egg Size: 45×31 mm Weight = 22.3 g (of which 5% is shell)

Clutch Size: 4 eggs | 3.87 ± 0.43 (2–5) N=905

Common redshanks are precocial and the success rate from hatchling to fledgling is c. 20-50 % in the wild. Mortality may increase dramatically during cold spells, especially in combination with rain. Mortality of 1st-year birds is around 55%, while mortality of adult individuals is around 30% per year (del Hoyo et al., 1996).

1.8 Behaviour

Most populations of this species are fully migratory and travel on a broad front over land and along coasts, with some Icelandic and Western European populations remaining close to their breeding grounds (del Hoyo et al., 1996). It breeds solitarily in pairs or in loose colonies (del Hoyo et al., 1996; BirdLife International, 2016) departing the breeding grounds from June to October and returning from the wintering grounds again between February and April (BirdLife International, 2016). Outside of the breeding season, the species forages singly, in small groups (del Hoyo et al., 1996), or occasionally in larger flocks of up to c.1,000 individuals (BirdLife International, 2016) especially at roosting sites or when feeding on fish (del Hoyo et al., 1996).

Common redshanks, like many waders, perform anti-predator behaviour through flocking, mainly to avoid predators like sparrowhawks (*Accipiter nisus)* and peregrine falcons (*Falco peregrinus)* (Cresswell, 1994). Flocking reduces an individual common redshank's probability of being killed by predators. Larger flocks were preferentially attacked, but an attack was significantly more likely to succeed on a smaller flock. Within a larger flock, a common redshank was less at risk through the dilution effect, vigilance effects (which were a direct consequence of flock size) and probably also the confusion effect, as it is more difficult for a predator to identify and track an individual in a large flock (Cresswell, 1994). The species is also susceptible to nest predation, from either native or introduced predators (del Hoyo et al., 1996; Jackson, 2001).

The following section has been extracted from Hale and Ashcroft (1983), as they provide an extensive overview of the courtship behaviour of common redshanks.

Early in the breeding season, common redshank displays largely concern the establishment and maintenance of the pair bond. The display flight and alighting ceremony play major roles in this context, but either display may give rise to courtship which leads to copulation.

Courtship ceremonies begin before arrival at the breeding areas and precocious males were seen to attempt copulation on the shore in late February and early March. Males clearly come into breeding condition before the females who are initially unresponsive to the males' displays. A resurgence of courtship behaviour occurs after egg loss. There are three major phases in the courtship behaviour: the ground chase, the scraping ceremony and the wing-lifting ceremony.

Ground chases between pairs of common redshanks were observed to be the first part of courtship leading to copulation. Chases usually begin when a group of common redshanks are feeding and suddenly two birds start running, one pursuing the other. Usually, the pursued is a female and the pursuer is a male. Sometimes the male walks towards the female in an attempt at copulation, flutters into the air and tries to alight on her back, but this is always unsuccessful as the female usually walks, runs or flutters away. Initially the male fans his tail and then begins the chase. The posture assumed by the male during the chase is not that of the normal walk or run. The male's feathers are fluffed which give him a more rounded appearance, and in addition the tail is fanned so that half is seen on either side of the tips of the folded wings (figure 5). In some cases, the wings are dropped slightly, exposing the whiteness of the rump.

Figure 5. A common redshank fanning its tail, photo courtesy of R. van Weeren.

During the chase, the male uses a *Too Too… Too Too* note which, although similar to the display flight call, are not repeated so quickly. The call differs from the usual 'calling from a raised perch' note in that it is always disyllabic and is directed at a bird which can be seen, as opposed to the usual function of the 'calling from a raised perch' note being directed at an unseen bird.

Occasionally, particularly when there are more than two birds involved in chases, a female will sit down and rest and take no further part in the chase for several minutes, although it is clear she is following what is happening to the other birds by the movement of her head. On some occasions a resting female re-joins the chase.

Male common redshanks produce false nests, which are normally referred to as 'scrapes', in tussocks of grass in the potential nesting area. The male normally approaches a tuft of grass and parts the blades, thus enabling him to move into the centre of the tuft whereupon he lowers his breast into the grass surface and rotates on it several times whilst scratching backwards with his feet. In lowering the breast, the wings were held slightly away from the body to gain lateral support, the rump became clearly visible as the primaries hang down loose and the tail is fanned. The bird usually spends up to

five minutes rotating around the scrape, kicking out soil and vegetation in the process, until a circle of bare earth some 8-10 cm in diameter is exposed. The male repeats the same quiet 'song', a low-pitched *Tu-too-tutoo- tu-too-too-tu-too*, throughout the scraping process and this usually begins when he approaches the tuft. After completing several scrapes, the male often prefers one particular scrape. The male continues to move in and out of the scrape, digging out the vegetation until a circle of bare soil 14-5 cm in diameter is exposed. This behaviour is interrupted from time to time by false brooding, which sometimes coincided with the action of grass pulling in which grass stems are pulled towards the scrape using the bill, so that there develops a dome or bower of vegetation over the nest, which camouflages it from above. During the construction of a scrape, the female is attracted by the performance of the male and usually approaches but does not enter the tuft. However, as scraping continues, the scraping male's mate is observed to become more inquisitive and, as soon as the male starts to line or camouflage the scrape, the female shows an increased willingness to enter.

The wing-lifting ceremony is the last part of courtship and might follow a chase or be continuous with the scraping ceremony. After a chase the female sometimes provokes the wing-lifting ceremony, and she does this by slowing down and becoming stationary. She then holds her bill and body in an almost horizontal position with the wings slightly parted to expose the rump. The male stops for approximately two seconds and then approaches to a position in front of the female with head erect and body drawn up tall and straight with a fanned tail. The male then opens his wings and raises them to an almost vertical position above his back, so displaying the white underside to the female (figure 6 & 7). On occasion it is observed that he lifts the wing which is facing the female before raising both wings into the vertical position. The male, still with fanned tail, then allows his wings to droop before fluttering them rapidly through a few degrees giving the impression of the vertical wings vibrating. At first the tips of the wings begin to tremble, and this shivering motion is extended until the whole of each wing is shaking violently. The song used by the male as he approaches the female, with neck stretched a little forward, head bowed and with bill pointed to the ground, is a continuous *Tloo-tloo* and is a single continuous note; the female responds with the spasmodic, rather nervous, single *tchip* call.

Figure 6. A male common redshank the displaying courtship behaviour ''wing-lifting'' in an open area next to a waterbody, photo courtesy of R. van Weeren.

Figure 7. A male common redshank the displaying courtship behaviour ''wing-lifting'' in an open area next to a waterbody, photo courtesy of R. van Weeren.

Section 2: Management in Zoos and Aquariums

This section has been compiled with information provided by ARTIS Amsterdam Royal Zoo, Rheine Zoo, Dresden Zoo, Wasit Wetland Centre part of Arabia's Wildlife Centre group and the Wildfowl and Wetland Trust (WWT) Slimbridge, as they have extensive experience with common redshanks and have experience breeding the species at their institution.

2.1 Enclosure

One of the aspects to promote animal welfare is through keeping animals in suitable environments that allow them to fulfil their main biological needs (Fàbregas et al., 2011). For this reason, when designing an animal enclosure, consideration must be given to the species' original environments (Shepherdson, 2003; Fàbregas et al., 2011), as well as its ecology and behaviour (Fàbregas et al., 2011), to ensure that the animal will find the necessary resources to meet its biological needs, and therefore promote its welfare (Hosey et al., 2013; Fàbregas et al., 2011).

2.1.1 Outdoor enclosure

This species should ideally be housed in larger aviaries that provide naturalistic and complex environments. Enclosures should resemble wetlands and coastal areas as these are the natural habitat of the common redshank. Common redshanks should ideally be housed in small groups, depending on the enclosure size and complexity of the institutions' enclosure, see figure 8 to 12 for examples.

Figure 8. A naturalistic and complex enclosure at ARTIS Amsterdam Royal Zoo, photo courtesy of K. Groot.

Figure 9. A naturalistic and complex enclosure at Rheine Zoo, photo courtesy of K. Groot.

Figure 10. A naturalistic and complex enclosure at Dresden Zoo, photo courtesy of M. Hendel.

Figure 11. A naturalistic enclosure at Wasit Wetland Centre, part of the Arabia's Wildlife Centre group, photo courtesy of D. Ruiz.

Figure 12. A naturalistic and complex enclosure at WWT Slimbridge, photo courtesy of S. Matthews.

2.1.2 Indoor enclosure

An indoor enclosure is necessary, necessary if your geographical region experiences prolonged freezing temperatures, but the species can stand light freezing temperatures. So, in case of high freezing temperatures, an indoor enclosure is needed and will also provide extra flexibility in managing this species, see figure 13 for an example. Alternatively, areas need to be provided that are kept above freezing temperature by utilising heaters or heat lamps for example. Be aware that a sufficient number of these areas need to be created so competition for warmth is minimised, depending on the size of your flock. If your institution experiences minus 2 °C for more than 48 hours then another source of warmth, either an indoor enclosure or heat lamps need to be provided.

Figure 13. A diverse indoor enclosure for wader species, including different substrates, a shallow pool and several different hiding places at ARTIS Amsterdam Royal Zoo, photo courtesy of K. Groot.

2.1.3 Boundary

Common redshanks should be housed in aviary-style enclosures. The enclosure should be constructed with strong and sturdy materials that can withstand the elements relevant to the institution, such as strong winds, heavy snowfall, or strong sun.

The boundaries of the enclosure can be covered with a strong metal mesh (≥1,8 mm wire width and ≤19 mm spacings) through which rats, weasels, snakes, or other predators cannot crawl. Do not pull the wire on the top of the aviary too tight, to allow for some “bounce” when a bird flies into it. The outdoor enclosure should be built on a strong foundation which is dug at least 50 cm deep to avoid predators digging their way into the aviary. Otherwise, metal mesh (≥1,8 mm wire width and ≤19 mm spacings) can also be dug ≥50 cm into the ground. Adding an extra strip of ≥20 cm metal mesh

horizontally at the bottom on the outside of the aviary will add extra security against digging predators like foxes.

Soft netting can also be utilised as an enclosure boundary, which decreases the risk of trauma if a bird flies into it. However, if the enclosure is made from soft netting, it is important to at least make the bottom 1 m out of stronger material like metal wire or stone wall. On the bottom part, at least 2 lines of electric wire should be placed next to the wall, and 2 more lines should be placed at a distance of 15 cm and 30 cm from the wall to prevent ground predators from jumping on the soft netting (e.g. squirrels). For the latter, it is also important to avoid having trees, fences or other large objects near the aviary from which the intruders can jump onto the soft netting.

In areas where there is much pressure from avian predators, a double ceiling can be a solution to prevent birds from being killed through the net. The safest option would be to add a separate net about 40cm above the top of the aviary, but even adding several lines of fishing wire above the top of the aviary has proven successful to deter hawks and owls. If a double aviary roof is used, the birds should not be able to enter this space, the extra net can also have a much larger mesh opening (up to 10cm) as its sole purpose is preventing raptor strikes.

In areas where snakes occur, it is important to take protective measures against these animals. To prevent snakes from entering under the fence, a 10cm deep metal mesh with a very small mesh opening (0.5 mm) can be installed around the base of the perimeter of the facility. This can be added to the mesh that stops digging predators from getting in. To deter snakes from entry higher up, an extra 1 m high fence (0.5 mm mesh opening) should be installed at a 30-45° angle from the outside wall of the enclosure and sealed to the bottom edge of the structure.

It is necessary to inspect the aviary for holes in or around the fences daily. Rats, weasels and polecats can cause serious havoc in an aviary and kill even adult birds.

2.1.4 Pest control

If rodenticides are required to control pest rodents, then legislation that is relevant to your country and area needs to be checked and understood. It is advised that you consult a local pest control expert to ensure you are practicing within the legislation, not causing harm to the environment and are following the correct method to control the infestation. Different rodenticides have different methods of use, and the label should always be read and followed. Ideally a *cocalciferol*-based bait should be used as this is much safer for the food chain. In general, rodenticides should not be used unless there is an active pest rodent infestation like rats or mice that are currently active at the site.

Poison baits for rats and mice should be placed in the surrounding perimeter of the aviary, but never inside the aviary where the birds can access it. The bait must be checked every 7 days and refreshed if needs be. A search for rodent bodies should also be completed during these checks. When the infestation is dealt with the bait must be removed. Mice are grazers so small amounts of bait in many locations is more effective than larger amounts in less locations. Most rodenticides are also dependent on regular feeding over several days at least, so do not let the rodenticide run out or the rodents will recover and become tolerant towards it.

The better alternative to poison bait is setting snap traps in a bird proof box/ tunnel or baffle at intervals along a wall-floor junction. Both mice and rats have poor eyesight and use muscle memory of wall floor junctions to navigate, so bait traps should always be along these junctions. The traps used should be able to kill in less than 30 seconds. Nonetheless, legislation that is relevant to your country and area needs to be checked and understood regarding the use of traps.

Rheine zoo has good experience with using Russell Terriers as pest control, however, please note that all birds should be housed elsewhere, for example in their indoor enclosure before using this pest control method. Rheine Zoo can be contacted for further information.

The availability of spilled or extra food should be avoided as much as possible. Placing the food dishes inside an easy to clean box will help keep the feeding station hygienic and reduce feeding opportunities for pest species. Feeding daily ratios that are eaten before dusk or removing the food before nightfall and placing new food in the morning will also help avoid mice infestations. The area around the aviaries should be kept as clean as possible, as mice and rats will nest under any kind of rubble.

2.1.5 Substrate

Ideally, more than one type of substrate should be used in the enclosure. Soil, short (soft) grass (be aware that blunt stems can potentially cause bumblefoot), different types of soft sand (such as silica sand) different types and sizes of gravel can be used in both the indoor and outdoor enclosure. ARTIS Zoo also uses different sizes of lava rock gravel, a benefit of these porous stones is that small insects and other organisms will occupy the rocks, so the common redshanks can forage naturally between this type of gravel.

Hard surfaces such as concrete and loam, both indoor and outdoor should be avoided at any costs to prevent birds from developing bumblefoot. Exposed concrete should ideally be covered with softer substrate (a minimum layer of 10 cm), or if exposed it should be scrubbed regularly to avoid getting slippery and to prevent urea from accumulating and causing feet problems. Water edges should also ideally be soft and if concrete is used, it should be covered with a softer substrate or a type of gravel. The gravel should ideally be rounded and smaller than 20 mm. Alternatively, butyl liner run over a wool cloth can be used to cover the harder concrete surfaces of ponds or indoor enclosures. This provides additional grip for the birds and keeps faeces and dirt away from their feet.

2.1.6 Furnishing and maintenance

Land Area

The enclosure should resemble the natural habitat of common redshanks as closely as possible, while also providing a complex and diverse environment. Different types of foliage, of different heights should be added to the enclosure, to provide shelter from visitors, conspecifics, and potential other species housed in the same enclosure.

Foliage also provides shelter for nesting, as common redshanks typically build their nest under grasses and other low foliage. The types of foliage that are used in the enclosure at ARTIS and at WWT Slimbridge can be found in Appendix I. Dresden Zoo reported that it is important to have direct sunlight shining into the aviary. An open area is needed for birds to display and perform territorial behaviour. These areas can be on land or close to the water edge, as common redshanks prefer sandbanks to roost on (figure 14 & 15).

Water area

Water areas should be shallow enough for birds to walk in so they can bathe and forage. The floors and banks of these water bodies should be covered with soil or gravel to allow the birds to forage and to prevent foot problems. A part of the waterbody can be divided into a slow running stream to encourage foraging behaviour and as enrichment (figure 17). It is important to notice that the water clarity and quality is essential for common redshanks to maintain their plumage. Therefore, their food(especially fish) should be provided away from the main waterbody within the enclosure.

Figure 14. An enclosure with sandy areas around the water edges at Dresden Zoo, photo courtesy of M. Hendel.

Figure 15. An open area where large groups of waders are able to congregate, display courtship and territorial behaviours, roost and nest on at ARTIS Amsterdam Royal Zoo, photo courtesy of K. Groot.

Figure 16. A common redshank perched on a willow stump, photo courtesy of R. van Weeren.

Figure 17. A common redshank foraging in a slow running stream, photo courtesy of K. Groot.

2.1.7 Environment

Adult common redshanks are hardy birds and can stand light freezing temperatures easily and can therefore be kept outside all year round in most European countries. However, if high freezing temperatures are more common in a country, it is advisable to have a suitable indoor enclosure for the species available. A temperature of about 5° to 10° C is fully sufficient in winter. Ideally, if an indoor enclosure is available, giving individuals the choice between outdoor and indoor all year round is the best option.

If an indoor enclosure is unavailable, additional warmth can be provided by placing a covered heat lamp in the outdoor enclosure. Alternatively, infrared heaters could be used to keep larger areas frost free.

If the species is kept (partially) indoors at an institution, specialized UV lighting is needed in the enclosure. For example, the T5 or T8 UV lighting from Arcadia. However, birds should be able to move away from these lights, therefore UV lighting should only be placed in one or more dedicated areas, with plenty of areas for birds to stand out of these UV spots. Dresden Zoo reported that it is important to have direct sunlight shining into the outdoor enclosure as well.

The lifecycle of common redshanks shows a high degree of seasonality. The influence of light might be crucial to keep up the life cycle and for synchronizing behaviour and may be crucial for breeding success depending on geographical regions. Common redshanks at Rheine Zoo are kept at a light-cycle in winter of 12 hours day / 12 hours night (7.00 am to 7.00 m light) in the indoor enclosure, to prolong feeding opportunities, however birds also have access to the outdoor enclosure with natural light cycles. Control clocks which regulate artificial lightning are needed to simulate the seasonal lightning changes.

Figure 18. Flood lights used at Wasit Wetland Centre, part of the Arabia's Wildlife Centre group. Photo courtesy of D. Ruiz.

Table 1. Light cycle utilised in the common redshank aviary at Arabia's Wildlife Centre.

Month	Morning		Evening	
	ON	OFF	ON	OFF
January	6:00	7:30	16:30	19:30
February	5:30	7:30	16:30	20:00
March	5:00	7:00	17:00	20:30
April	4:30	7:00	17:00	21:00
May	4:00	7:00	17:00	21:30
June	3:30	7:00	17:00	22:00
July	4:00	7:00	17:00	21:30
August	4:30	7:00	17:00	21:00
September	5:00	7:00	17:00	20:30
October	5:30	7:00	17:00	19:30
November	Off	Off	Off	Off
December	Off	Off	Off	Off

Arabia's Wildlife Centre has installed flood lights which extend the light in the aviary in the spring by several hours, which pushes the breeding season forward for their common redshanks. These lights are utilized to avoid birds from breeding in the heat of the summer months and is recommended if institutions are located in warmer climates (figure 18 & table 1).

2.1.8 Dimensions

Although the dimensions of enclosures differ between holders, an enclosure should be large enough to sufficiently house a small group (3.3.0) of common redshanks. Therefore, the starting size of an outdoor enclosure should be 25 m^2, and an indoor enclosure should be at least 10 m^2, but the size of the enclosure should increase if the group size increases. However, the species really thrives in larger aviaries that provide naturalistic and complex environments, and therefore the EEP recommends keeping the species in these large enclosures. Careful consideration should be made regarding the size of enclosures when this species is kept in a mixed species enclosures.

At WWT, the common redshank enclosure has a maximum height of 12 metres. They are very agile in flight and can use the whole of the available space, while many other wader species inhabiting the enclosure use less of this available space.

2.2 Feeding

2.2.1 Basic Diet

The basic diet of common redshanks in zoos should resemble the nutritional contents of wild common redshank diets as closely as possible. As the species is mainly insectivorous, the main components of the diets should be:

A pellet high in protein such as a sea or wading bird pellet, for example Micro® from Lundi Farm or Anseres sea-duck floating from Kasper Fauna Food. Insect pate, multiple brands can be used. A variety of insects such as mealworms, buffalos or pinkies for example. All insects should always be supplemented, for example with AviTotal, Nekton -S, Avipro or DK multivit ® and can be gut-loaded with carrot and pellets such as Lundi. Additionally, a soaked insect-based pellet can be used, for example from Bellefor. Fish such as smelts, or any types of crustaceans should be fed as part of a balanced diet. However, as common redshanks are mostly kept in mixed-species enclosures with other wading species, it will be unavoidable to prevent common redshanks from eating fish if they are part of the diets of the other species. However, close monitoring is necessary due to potential health issues such as gout. A complete diet sheet, implemented at ARTIS Zoo and Arabia's Wildlife Centre can be found in Appendix II. The diet for Arabia's Wildlife Centre group is an example of a homemade diet, if commercial pellet is not available.

2.2.2 Special Dietary Requirements

Chicks, either parent-reared or hand-reared, should be fed exclusively on insects. At ARTIS, chicks that are being hand-reared are only fed with buffalo worms and Micro® from Lundi Farm for the first 12 days of rearing. If parent-rearing occurs, keepers will feed additional buffalo worms around the nest-site xx times a day. All insects are supplemented with AviTotal. Further methods of hand-rearing and the provision of the hand-rearing diet will be explained in paragraph 2.4.4. Hand-rearing.

2.2.3 Method of Feeding

The diet should be offered at least two times per day, but this can be increased to up to four times. However, some diet components, such as the pellet and insect pate, should be available all day long.

If chicks are being parent-reared, insects such as buffalo worms should be offered at least four times a day.

The species can either be fed outdoor or indoors (if available), depending on the preference of the birds and keepers. It might be practical for habituated birds to eat inside, or in a holding enclosure which will allow for an easier catch up if your outdoor enclosure is considerably large. If the pellets and/or insect pate are fed outside, the bowl/ tray should ideally be placed under cover (figure 19), so these diet components cannot get wet.

Figure 19. A dish with pellets, covered by a simple structure to protect it against the rain, at ARTIS Amsterdam Royal Zoo. Photo courtesy of K. Groot.

Pellets and insect pate can be fed in a low bowl, or a feeding tray, the insects can either be scattered into this bowl/ tray or scattered across the enclosure to increase foraging time for the species as a form of enrichment.

WWT Slimbridge utilises a shallow tray with a feeding bowl situated inside. The shallow tray is filled with salt water (figure 20). The salt has a double purpose, it helps to prevent bumble foot by keeping the feet clean, especially if the individual has any gaps or breaks in the skin. It also helps to keep slugs and ants off the food. The saltwater solution consists of 40 g table salt and 6 L of water.

Figure 20. The feeding set-up surrounded by salt water, utilised at WWT Slimbridge, photo courtesy of S. Matthews.

2.2.4 Water

Water should be available through the waterbody (or bodies) situated inside the enclosure, or through water bowls. It is important that these water sources do not hold dirty water, and they should be checked and cleaned regularly.

2.3 Social structure

2.3.1 Basic Social Structure

In the wild, common redshanks change their social structure throughout the year, depending on the season. From solitary pairs and loose colonies during the breeding season, to living singly, in small groups or occasionally in larger flocks of up to c. 1,000 individuals outside of the breeding season (see section 1 for more information). Therefore, it is difficult to determine what the best social group structure in zoos should be. WWT Slimbridge currently houses a group of approximately 20 individuals together. ARTIS currently houses 4.6.0 common redshanks in a large natural aviary without any problems and does not foresee any problems when potentially adding additional birds in the future. Dresden Zoo currently has a group of around 28 individuals in a large natural aviary without any aggression problems. Arabia's Wildlife Centre reported that a group of common redshanks should not be comprised of less than 10 individuals, with an ideal structure of 60% females and 40% males. While WWT Slimbridge suggests maintaining an even sex-ratio would be beneficial.

Figure 21. A group of common redshanks flocking together at Rheine Zoo, photo courtesy of K. Groot.

Therefore, the EEP suggests deciding on group structures depending on available space. Housing one or two pairs if the space is around 25 m^2 or less and expending the group if the species is housed in a larger aviary.

Birds can stay in their basic group structure all year round. However, monitoring the group throughout the year is important to notice any changes in the social dynamics of pair(s) and within groups, as the group composition and dynamics might influence the breeding success of common redshanks.

Outside of the breeding season, common redshanks tend to flock together as seen in figure 21 and will roost together as a mass during the day in the sunshine. While during the breeding season they are more territorial and defend their own area within the enclosure. It is especially important to observe the males within the flock, as they need to have enough space to hold a territory without too much conflict with adjacent males while defending their territory.

2.3.2 Changing Group Structure

Changing the group structure of common redshanks normally does not pose a problem. Normally, an added individual can be added straight away into the group without a problem after their quarantine period.

However, as some aggression may occur after these changes, it will be important to monitor the birds during and in the first few days after the introduction. When aggression occurs, attempts should be made to reduce this aggression such as adding additional visual barriers, hiding spaces and reducing

food competition by spreading out food. In rare cases, an individual might need to be removed but should only be done after trying the other mitigation methods mentioned above.

It will also be important to increase the monitoring of this species prior and during the breeding season, as there will be a higher chance of aggressive behaviour occurring between conspecifics.

2.3.3 Sharing Enclosure with Other Species

Common redshanks are peaceful to other cohabitants in a mixed species enclosure but are strong enough to withstand any territorial aggression of other waders such as stilts or avocets. Keeping common redshanks in mixed-species enclosures might be an advantage as they are able to direct potential frustrations and aggressive behaviour towards other species instead of conspecifics.

In Rheine, common redshanks are kept with a variety of wading birds, such as pied avocets (*Recurvirostra avosetta*), black-winged stilts (*Himantopus himantopus*), ruffs (*Calidris pugnax*), common ringed plovers (*Charadrius hiaticula*), and Northern lapwing (*Vanellus vanellus*). Rheine has not observed any aggressive behaviour from these species towards the common redshanks and does not believe that the species suffers in any way from other waders cohabiting the enclosure. However, Eurasian oystercatchers (*Haematopus ostralegus*) have been removed from the enclosure as there were signs that they damaged eggs laid by the other waders.

ARTIS houses common redshanks with Eurasian spoonbill (*Platalea leucorodia*), pied avocets (*Recurvirostra avosetta*), black-winged stilts (*Himantopus himantopus*), Northern shoveler (*Spatula clypeata*), lesser white-fronted goose (*Anser erythropus*), red-breasted goose (*Branta ruficollis*) and European rollers (*Coracias garrulus*) without any problems.

Arabia's Wildlife Centre keeps common redshanks with pied avocets *(Recurvirostra avosetta)*, ruff (*Calidris pugnax*), Eurasian curlew (*Numenius Arquata*), grey plover (*Pluvialis squatarola*), black-tailed godwit (*Limosa limosa*), common ringed plover (*Charadrius hiaticula*), curlew sandpiper (*Calidris ferruginea*), marbled teal (*Marmaronetta angustirostris*), Eurasian oystercatcher (*Haematopus ostralegus*) without any problems.

Dresden Zoo houses common redshanks with common ringed plover *(Charadrius hiaticula)*, little grebe (*Tachybaptus ruficollis*), common sandpiper (*Actitis hypoleucos*), Eurasian curlew (Numenius Arquata), corncrake (*Crex crex*), harlequin duck (*Histrionicus histrionicus*), red-breasted goose *(Branta ruficollis)*, grey wagtail (*Motacilla cinerea*) and Bohemian waxwing (*Bombycilla garrulus*) without any problems.

WWT Slimbridge houses common redshanks with pied avocets (*Recurvirostra avosetta*), ruff (*Calidris pugnax*), black-tailed godwit (*Limosa limosa*), ringed plover *(Charadrius hiaticula)*, Eurasian oystercatchers (*Haematopus ostralegus*), little egret *(Egretta garzetta)*, garganey (*Spatula querquedula*), red-breasted merganser (*Mergus serrator*) and smew (*Mergellus albellus*) without any problems.

2.4 Breeding

Successful breeding might occur from one pair, but there are also zoos that breed from multiple pairs in one breeding season. Nevertheless, caution must be implemented as aggressive behaviour towards conspecifics can occur. However, as mentioned in paragraph 2.3.1. it is presumed that this correlates with the available space in the enclosure.

2.4.1 Mating

As described in paragraph 2.3.1, birds can stay together all year round. Courtship and territoriality-displays are observed easily, especially in open areas of the enclosure. Behaviours observed prior and during the breeding season in common redshanks are staying close together as a pair, increased activity and individuals being more vocal; they often call on perches within the aviary. Courtship behaviours observed are mostly males jumping and flapping their wings next to the female in open areas of the enclosure, whereafter mating is often observed (figure 22). Females are sometimes seen crouching near males, simulating their breeding display which culminates in copulation. The females then slide off into patchy undergrowth such as thrift and males will often perch on lookout nearby.

Figure 22. A pair of common redshanks copulating on the water edge at an open space, photo courtesy of R. van Weeren.

2.4.2 Egg Laying, Incubation and Hatching

It is often difficult to detect nests in landscaped aviaries. Warning-calls of the parent birds might give a good indication if approaching a nest site. At ARTIS, WWT, Dresden and Rheine, nests are marked with a number and noted on a map or data sheet (figure 23).

Eggs are mostly laid between foliage, such as bushes, shrubs, ferns or grasses (figure 24). Some dead or dried twigs, grass or straw are used to build a nest, often these are materials that the common redshank can find themselves in natural and landscaped enclosures. ARTIS additionally provides bales

of straw in the enclosure for the different occupants to use as nest material. At Arabia's Wildlife Centre, nests are built in more open areas, on stone substrates or against larger stones, even though foliage is available to build a nest under or nearby.

Figure 23. Nest-markers being used at WWT Slimbridge and ARTIS Amsterdam Royal Zoo, photos courtesy of S. Matthews and K. Groot.

Clutches often have three to four eggs; clutches of eggs are transferred to the incubator as soon as 4 eggs (or 3) are laid at both ARTIS and Rheine. Re-clutching in common redshank is observed in the species at both institutions but is not very common. Natural incubation in mixed-species enclosures with a large population of different species can be successful and has happened several times with non-detected clutches at both institutions. However, to increase breeding success and increase the population, most clutches are collected for artificial incubation and hand rearing at both ARTIS and Rheine. Natural incubation is always advised, due to the enriching value of rearing chicks. However, breeding methods depend on the feasibility of the institution, enclosure and species mixed with common redshank. Advice on breeding methods by the EEP should always be followed as strategies might change in the future.

Figure 24. A well camouflaged nest between a marsh fern (*Thelypteris palustris*), photo courtesy of N. Burek.

The natural incubation period ranges between 23-24 days. Normally, a female will start incubation after the third or fourth egg is laid, therefore, the hatching seems to be synchronized. The artificial incubation parameters at different holders are as followed (table 2).

Table 2. Different artificial incubation parameters, utilized at zoos breeding common redshank. There is no one size fits all for these parameters and therefore institutions should find the parameters that work best for them.

Institution		Incubation	Hatching
ARTIS	**Temperature**	37.2 °C	36.6 °C
	Humidity	± 30%	60%
Arabia's Wildlife Centre	**Temperature**	37.5 °C	37 °C
	Humidity	60%	60 – 80%
Rheine Zoo	**Temperature**	37.6 °C	37.6 °C
	Humidity	64%	75%
WWT Slimbridge	**Temperature**	37.5 °C	37.5 °C
	Humidity	45%	70%

It is advisable to put an additional thermometer and hygrometer inside the incubator and hatching incubator as a safety measure.

At ARTIS, once the chick has entered the air cell, the egg is transferred to the hatching incubator. From then on, the hatching process can take up to three days. Once the chick is fully hatched, it is transferred to a brooder from Brinsea at a temperature of 35 °C. Most chicks stay in the brooder for 0.5 to 1 day. If a chick is squinting its eyes a lot, additional water can be sprayed into the brooder to increase the humidity temporarily.

2.4.3 Development and Care of Young

Hand rearing is the most prevalent rearing technique at the moment and therefore most eggs are collected for artificial incubation. Sometimes a nest can be missed by the keepers, which result in parent reared birds (figure 25 & 26). Both ARTIS Zoo and Rheine Zoo have had this happened in the past and although several chicks were reared successfully, there was a higher mortality rate with parent reared chicks, potentially due to unexperienced parents, external factors such as temperature and possibly due to predation from pests such as rats. Furthermore, if your institution decides on parent-rearing common redshank, a protocol should be in place to capture the chicks in the first few days after hatching to band and ID these individuals.

Unlike other wader species such as ruff and avocet, they are not prone to develop angel wings, and the chicks are in general very self-sufficient and resilient.

Dresden Zoo only utilises parent-rearing and has good success with this, potentially due to the lack of pests entering the aviary, which is another example of why it is of utmost importance to keep your enclosures free of harmful pests such as rats.

If chicks are discovered in the enclosure, keepers should monitor the parents and chicks closely and a tray of food compromising of the same diet as the hand rearing diet should be placed in the vicinity of the nest. Additional (approximately 30 grams) of buffalo worms should be fed twice a day in the vicinity of the parents and chicks, to increase food intake and make it easier for the parents and chicks to find food.

Figure 25. A common redshank chick being parent-reared at ARTIS Amsterdam Royal Zoo, photo courtesy of R. van Weeren.

Figure 26. A common redshank chick and parent at ARTIS Amsterdam Royal Zoo, photo courtesy of R. van Weeren.

2.4.4 Hand-Rearing

Hand-rearing starts after the chick is dry and starts to be active, which can then be transferred from the brooder to the first hand-rearing tub. The process described below is the protocol used at ARTIS Zoo for hand rearing waders such as common redshanks, (table 3). The EEP aims to build a foundation of knowledge that can be applied to more complex projects in the future, such as head starting initiatives and the conservation of other wader species. Therefore, if your institution is seeking to build their hand-rearing expertise, this species is a suitable choice.

Layout hand-rearing tubs

Each hand-rearing tub consists of the same base. The table below show all the relevant temperatures and alternate sizes that created the right conditions for the chicks. Each grow box additionally features conifer branches (or a similar species) to provide shelter to the chicks; this is placed both on the box and in the box to create quiet areas on both fronts. Each tray is also equipped with a heat lamp (corresponding height + temperatures in table) and a UV lamp per two rearing tubs, see figures 27 & 28.

The base of the tanks consists of a base of wire mesh and water with a base of pebbles or marbles; the water should always be always running in the rearing tubs. The floor mesh is covered with various types of greenery (this can also be artificial due to hygiene) to keep the breeding tank as natural as possible. The greenery substrate helps with promoting proper leg growth and prevents any possible leg problems. Rheine uses a similar set up but has towels covering the ground of their rearing tubs (figure 29). They try to avoid brightly coloured walls and towels as they suspect it gives the chicks a more secure feeling.

All of the hand-rearing tubs have the following measurements:

Table 3. Overview of the different hand-rearing tubs and their features at ARTIS Amsterdam Royal Zoo.

Tub	Measurement tub	Height lamps	Temperature	Measurements water source	Water depth	Diet
1	121 x 55 x 55 cm	33 cm	35 °C	N/A	1 small plate with water and pebbles	Plate with micro and buffalo worms
2	121 x 55 x 55 cm	46 cm	28 °C	30 x 30 cm	1 cm	Plate with micro and buffalo worms
3	121 x 55 x 55 cm	50 cm	22 °C	30 x 30 cm	2 cm	Plate with micro and buffalo worms
4	121 x 55 x 55 cm	55 cm	18 °C	55 x 60,5 cm	4 cm	Plate with micro and buffalo worms
5	121 x 73 x 55 cm	N/A	Ambient temperature	Half of the entire surface	5 cm	Plate with micro and mealworms
6	121 x 73 x 55 cm	N/A	Ambient temperature	Half of the entire surface	5 cm	Plate with micro and mealworms


Figure 27 & 28. layout of a hand-rearing tub, with and without lid at ARTIS Amsterdam Royal Zoo, photos courtesy of K. Groot.

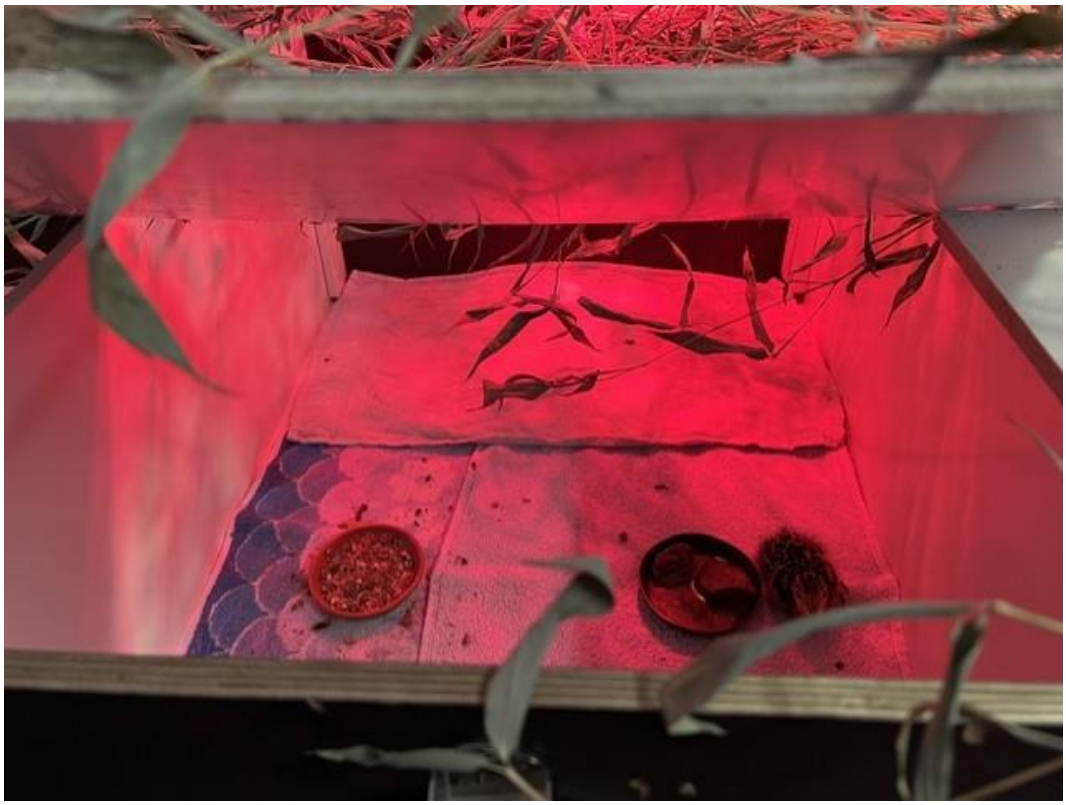

Figure 29. Layout of a hand-rearing tub at Rheine Zoo, photo courtesy of K. Groot.

Transfer scheme

In the table below, a transfer scheme can be found, which states the approximate time between transferring a chick from one tub to the other. However, please note that this is dependable on the individual chick's growth and development rate, see table 4. This scheme should only be used as a guideline (table 4).

Table 4. Overview of the transfer scheme utilized at ARTIS Amsterdam Royal Zoo.

	Tub 1	**Tub 2**	**Tub 3**	**Tub 4**	**Tub 5**	**Tub 6**
Days	2 – 3 days	3 days	3 days	3 days	3 days	3 days

After approximately 20 days in the rearing tubs, the chicks can be moved to a larger enclosure/ indoor enclosure. This enclosure provides different types of substrates, different hiding opportunities, a small pool filled with pebbles (figure 31) and a UV and heat source, see figure 30.

Heat and UV lighting

As mentioned earlier, every rearing tub is equipped with a heat lamp and UV light.

The heat lamp is suspended on different heights according to the temperature requirements (see table 3).

UV lights are kept on fixed distance from the floor of the rearing tubs or indoor enclosure and are set on a timer, at a 10-hour light cycle.

Figure 30. Set up of the heat and UV lamps at ARTIS Amsterdam Royal Zoo. Photo courtesy of K. Groot.

Figure 31. Large water pool in the rearing enclosure at ARTIS Amsterdam Royal Zoo. Photo courtesy of K. Groot.

Alternatively, if you want to expose common redshank chicks to natural sunlight, a set-up illustrated in figure 32 can be utilised. It is important to notice that the ¨tent¨ should be partly covered for shelter, so a heat lamp can be installed. The inside of the tent is lined with soft material to protect the wings. Please note that chicks are normally a few weeks old before they are given access to this set-up during the day and it is also weather-dependent. However, individuals are moved into this set-up full time from three to four weeks old. Also be aware that grass should not be too blunt for smaller chicks to prevent foot problems.

Figure 32. A hand-rearing tent utilised at WWT Slimbridge, photo courtesy of S. Matthews.

2.4.5 Population management

The EEP has been established in 2024 after the recommendation in the Regional Collection Plan in 2023.

The TAG decided to establish an EEP for common redshanks based on several factors. Firstly, it aims to address the potential issue of inbreeding by implementing group management strategies (similar to those used for freshwater teleost). This approach will help maintain genetic diversity within the ex-situ population and contribute to the long-term sustainability of the species. Additionally, the EEP will focus on developing comprehensive Best Practice Guidelines for common redshank husbandry, benefiting not only this species but also other similar waders within EAZA institutions. By promoting the species and encouraging more holders to gain expertise in wader care, including hand rearing techniques Regular reviews of the EEP will ensure its effectiveness and provide opportunities for improvement. In addition to its conservation role, the common redshank will serve as an ambassador for other waders, allowing visitors to learn about the diverse species that share its habitat.

2.4.6 Behavioural enrichment

The most efficient method of providing common redshanks with behavioural enrichment is housing them in large aviaries that provide naturalistic and complex environments. Which means providing them with a variety of different foliage, landscapes and substrates within the enclosure. Vertical perching options and a stream are also deemed enriching for common redshanks.

Scatter feeding live insects is also recommended as a good form of behavioural enrichment, which enhances foraging behaviour and the time common redshanks forage.

2.5 Handling

2.5.1 Individual Identification and Sexing

Common redshanks in breeding plumage are a marbled brown colour, slightly lighter below. In non-breeding plumage they become somewhat lighter-toned and less patterned, being rather plain greyish brown above and whitish below. They have red legs and a black-tipped red bill and show white up the back and on the wings in flight. Females often have paler upperparts than males, which is more prevalent in *t. totanus*.

However, to be 100% sure about an individual's sex, especially in chicks and juveniles, the EEP recommends DNA sexing using feathers.

Common redshanks should be banded with a 5mm band. On the leg band, the following information can be present: year of birth, serial number from the institution, band size and individual number for each bird. This information should be provided to the studbook keeper who will give the bird its studbook number. The studbook number, institutional ID and the information on the band should be kept in a registrar or ZIMS at each individual institution together with other observations about the animal (veterinary reports, breeding results, pairing, etc.).

Generally, males should have the metal band placed on their right leg and the female's band should be placed on her left leg, rings should ideally be placed above the ankle.

Banding should ideally be done between the first- and fifth day after hatching, depending on the size and the growth rate of the individual.

2.5.2 General Handling

During cleaning, keepers need to keep note of where the birds are and allow them to walk around them. When approaching the birds, they tend to walk away from the keepers, therefore it is important to leave enough space between the keeper and bird and to not push them into a corner. This way, birds can walk or fly around the keeper in the opposite direction.

2.5.3 Catching/Restraining

Capture time should be limited to the coolest times of the day. If the transfer is within an institution, the transfer is best done in the morning so the bird can be kept under surveillance in its new enclosure throughout the rest of the day. Capture can be done by hand, but a net will make it quicker and easier. Nets should have deep bags which are made from a strong but flexible material like solid cotton cloth or small-sized mesh. The rims of the net should either have soft cushions or be made from a somewhat flexible metal wire (figure 33).

Figure 33. Net used at ARTIS Amsterdam Royal Zoo, note the small mesh size and the rubber edge around the ring to avoid injuries when catching. Photo courtesy of R. Castaing.

If possible, common redshanks should be caught in the indoor enclosure. Capturing birds in the outdoor enclosure is often more difficult because of the furnishing and there is a high risk of the bird crashing into the wire, damaging the beak and/or head with a risk of killing itself. Ideally the bird that needs to be captured is isolated in the indoor enclosure, away from other animals in the same aviary. Capture for transport should be as quick and efficient as possible. The longer it takes to catch a bird, the higher the chances of a bird getting injured. To reduce the risk of injury it is better to anticipate where the bird is going and at the last moment, hold your net in front of the animal as it goes in this direction, letting it walk/run or fly into your net rather than cornering the animal and smashing a net over it. The chances of trauma or death will be much smaller with the first technique. When catching birds with more than one person, make sure to have a good communication about who is going to catch which bird; do note that this may change over the course of the catching.

When the bird is netted, the net should be pressed to your chest with the opening of the net pointing towards you. Hold the net with one arm and reach into the net with the other arm. Another technique is to press the opening of the net against the floor and then reaching into the net to grab the bird. Never fixate the bird with anything else then the legs or the body; taking hold of the wings, tail or the head will lead to a loss of feathers or an injured or dead bird.

One of the safest ways to hold a common redshank or wader is to hold the bird with the back of the bird in the palm of your hand, holding the neck between your middle and index finger. This way, your other hand is free to fixate the legs or beaks for example, see figure 34. When captured, birds can go into stress cardiomyopathy. If you feel that the breathing decreases, muscle tension loosens, the eyes start closing and the beak is open, it is important to immediately put the bird on the ground and let it rest until it recovers.

Figure 34. Handling and restraining method for common redshank, photo courtesy of K. Groot.

2.5.4 Transportation

When transporting common redshanks by air travel, IATA Live Animal Regulations need to be followed (IATA, 2020). Common redshanks should be transported individually, placing several birds in one crate will always end up in individuals getting injured or worse. A standard transport crate used at ARTIS measures 33 x 25 x 30 cm (L x W x H). The floor can be covered with a piece of carpet or some greenery to provide some stability during the transport, see figure 35. WWT Slimbridge utilizes cardboard or soft plastic boxes which are both foldable and soft, see figure 36.

Figure 35. Simple transportation box, which can be utilized for common redshank, notice the foam added to the ceiling and greenery placed on the floor to prevent the birds from sliding, photo courtesy of K. Groot.

Figure 36. Transport box utilised at WWT Slimbridge, photo courtesy of S. Matthews.

2.5.5 Safety

Common redshanks are by no means dangerous animals, and therefore the keeper can walk freely inside the enclosure. For the safety of the birds, it is important that enclosures have a double door system to prevent escapes.

2.6 Veterinary considerations for health and welfare

The common redshank like many other birds faces various dangers and health challenges in the wild, along with specific veterinary care issues if in captivity or under rehabilitation.

Natural dangers in the wild are predation; where nestlings and eggs are particularly vulnerable to ground predators like rats and foxes (Thyen & Exo, 2003). Early mowing of the nesting areas is also a relevant cause of death in common redshank (Exo et al., 2017). Habitat loss through wetland drainage for agriculture or urban development reduces available feeding and nesting areas (Żmihorski et al., 2017; Del Hoyo et al., 1996). In some areas pollution also poses a risk to their habitat; recently a study on heavy metal poisoning was published which established a baseline and found heavy metals such as lead in the blood of common redshanks (Hussain et al., 2024). Climate-induced habitat alteration can disrupt their migratory and breeding behaviours. Changes in water levels or temperatures reduce the availability of the invertebrates (like worms, crustaceans, and small molluscs) that make up the common redshank's diet (Biswas et al., 2023). Human activities like tourism, fishing, and boating in coastal areas can disturb feeding and nesting sites. Disturbances may cause birds to abandon nests or fail to breed successfully (New Hampshire Fish and Game Department, 2015; Goodship & Furness, 2023).

Wading birds, like common redshanks, can be infected with avian influenza and also become carriers of the avian influenza virus. Though they may not always show symptoms, the disease can affect populations and spread to other species. Part of the vulnerability is caused by their natural behaviour; they live in dense groups during certain periods of the year and mix with other species. It is suspected that this is an important factor, as there are more opportunities for virus transmission (exposure) and for possible species-specific adaptation of the virus in such groups. In addition to avian influenza, viruses such as, avian paramyxovirus have also been detected in waders. It is crucial to monitor emerging and re-emerging viral diseases in avian species and to always consider them in management practices.

Botulism occurs both in the wild as well as in captive situations when birds ingest toxins produced by *Clostridium botulinum*. Common redshanks may be more susceptible because they forage in shallow waterlogged areas with decaying organic material. This infection can cause paralysis and death and is not always easily diagnosed in early stages. Bacterial infections in general are relatively uncommon compared to Passeriformes.

Systemic fungal infections, most often caused by *Aspergillus* species, are infections that primarily manifest clinically when the immune system is compromised (when the body's defence mechanisms are weakened) or when there is a high infection pressure. This weakening of the immune system can result from factors such as malnutrition, chronic stress, underlying illnesses or immunosuppressive treatments. Additionally, when there is high infection pressure, meaning a large number of infectious agents or frequent exposure to pathogens, the immune system may become overwhelmed, leading to the disease becoming symptomatic. In these situations, pathogens can more easily spread, multiply, or adapt, resulting in more pronounced clinical signs.

High infection pressure can particularly be the case in damp environments where mould growth is common or in less ventilated inside (winter) enclosures where outbreaks of contagious diseases in overcrowded or unhygienic conditions are more frequently seen.

Endoparasites (internal) such as nematodes, trematodes, and cestodes can infect the intestines or other organs. Ectoparasites (external) like mites, lice, and ticks are less common in captive birds but may become obvious when birds are in a poor condition.

Another virus possibly dangerous for common redshank is Newcastle Disease (ND) which can affect the respiratory, nervous, and digestive systems, leading to breathing difficulties, tremors, or death.

Bumblefoot, or pododermatitis, is a condition that can affect wader birds and is characterized by inflammation, swelling, and sometimes ulceration of the footpads. This condition can pose significant health risks to common redshank, which rely on their feet for foraging, mobility, and breeding. The most important factors contributing to bumblefoot in waders are environmental , such as unsuitable flooring and/or substrates and limited variation of substrates leading to abrasions or pressure wounds on the foot which can lead to infections. These environmental factors are often combined with physical factors like excess body weight, which increases pressure on the footpads, making them more susceptible to injury and infection.

Nutritional deficiencies that lead to reduced tissue quality and consequently result in fissures, cracks and pressure sores. Not only vitamins but also other essential nutritional deficiencies (proteins, fatty acids, minerals etc.) can impair skin health and immune function, making the feet more susceptible to traumatic injury and infections. Limited movement can lead to poor circulation in the feet and inadequate variation in stance, again making them more susceptible to sores and infections.

Traumatic injuries in common redshank can occur in aviaries due to their flying and escaping behaviour. Like many shorebirds, common redshank exhibit specific flight behaviours that can predispose them to traumatic injuries in confined spaces such as aviaries. They may take off quickly when startled, and often one bird triggers the group, which can lead to collisions with walls, cages, or other structures. Their natural instinct to evade predators can result in sharp turns, increasing the likelihood of crashing into obstacles or the walls and roof. Juvenile or inexperienced birds may lack the flying skills necessary to navigate confined spaces safely, resulting in a higher incidence of traumatic injuries. To minimize the risk of traumatic injuries within aviaries, ensure the aviary is spacious enough to allow for safe flight and movement. Design aviaries with rounded edges and soft materials (soft netting to absorb the collision) to reduce injury risk. Create hiding spots or sheltered areas within the aviary to help birds feel safe and reduce panic responses. Training birds by positive reinforcement and establishing a routine to enter a smaller (night) enclosure can significantly enhance the capture process, leading to a more friendly and efficient method of handling. One-time limited wing clipping can be a beneficial strategy for facilitating safer and more effective introductions of birds into new environments or situations. While it provides short-term safety benefits, it is crucial to consider the ethical implications and ensure that the birds are well cared for throughout the process. This should only be a last resort measurement, and should only be implemented when all other mitigation measures have been tried.

While treating wader birds presents unique challenges, it aligns with general avian treatment protocols. Creating a safe, smaller hospital area for these birds, along with effective techniques for administering medications is critical to ensure their health and recovery. If the birds are actively eating, medications can be administered through their food. Techniques include gut-loading insects with the necessary medication or injecting it into food items that are preferably intended to be swallowed whole. Through careful management and a skilled approach, caregivers can significantly improve treatment outcomes for waders, leading to better overall health and well-being.

2.6.1 Specific problems

In principle, common redshanks are one of the more uncomplicated species of waders. Therefore, there are no species-specific problems except for the group compatibility uncertainty described in paragraph 2.3.1.

2.7 Recommended research

The following recommended research questions have been compiled below:

- Research could focus on the genetic diversity within the population and the sub-species composition within the EAZA population.
- Is there any difference in welfare and/ or health regarding the banding of individuals above or below the ankle.
- Research into the ideal group composition and optimal breeding results would also be interesting to conduct.
- Research into their interest in scavenging and foraging on different protein sources.
- Research into the most prevalent cause of death in common redshank, and potential mortality trends within the EAZA population.
- Research into factors increasing breeding success and simultaneously, research into factors limiting breeding success.
- Research into the suitability of enclosures and provided care to find the optimal situation(s) for breeding.

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Appendix I Plant lists

1. **List of plants utilised in the wader enclosure at ARTIS Amsterdam Royal Zoo**

Scientific name	**Common name**
Achillea millefolium	Common yarrow
Acorus calamus	Sweet flag
Acorus gramineus 'Licorice'	Japanese sweet flag 'Licorice'
Acorus gramineus 'Ogon'	Japanese sweet flag 'Ogon'
Alisma plantago-aquatica	European water-plantain
Angelica archangelica	Garden Angelica
Calla palustris	Watur arum
Caltha palustris	Marsh Marigold
Comarum palustre	Marsh cinquefoil
Euphorbia palustris	Marsh spurge
Hippuris vulgaris	Common mare's-tail
Hydrocotyle vulgaris	Marsh pennywort
Iris pseudacorus	Yellow iris
Juncus effusus	Soft rush
Leucanthemum vulgare	Ox-eye daisy
Lychnis flos-cuculi	Ragged robin
Preslia cervina	Water Spearmint
Prunella hybrid	Prunella Summer Daze
Thelypteris palustris	Marsh fern
Typha minima	Dwarf bulrush
Cornus mas	Cornelian cherry
Crataegus monogyna	Common hawthorn
Salix caprea	Goat willow
Rosa canina	Dog-rose
Typha latifolia	Bulrush
Salix alba	White willow

2. List of plants utilised in the wader enclosure at WWT Slimbridge

Scientific name	Common name
Alnus glutinosa	Common alder
Betula pubescens	Downy birch
Salix purpurea	Purple willow
Salix viminalis	Basket willow
Salix cinerea	Grey willow
Viburnum opulus	Guelder-rose
Carex vulpina	Fox Sedge
Caltha palustris	Marsh marigold
Hydrocotyl vulgaris	Marsh pennywort
Iris pseudocorus	Yellow flag iris
Juncus effuses	Soft rush
Angelic sylvestris	Wild angelica
felix femina	Lady fern
Caltha palustris	Marsh marigold
Carex paniculata	Tussock sedge
Dryopterus dilatatus	Broad buckler fern
Equisetum fluviatile	Water horsetail
Filipendula ulmaria	Meadowsweet
Iris pseudocorus	Yellow flag iris
Juncus inflexus	Hard rush
Lythrum salicaria	Purple loosestrife
Mentha aquatic	Water mint
Thelypterus palustris	Marsh fern
Oenanthe crocata	Water dropwort
Osmunda regalis	Royal fern
Valeriana diocia	Marsh valerian
Phragmites australis	Common reed
Carex riparia	Greater pond sedge
Iris pseudocorus	Yellow flag iris
Schoenaplectus lacustris	Common club rush
Achilleic ptarmica	Sneezewort
Acorus calamus	Sweet flag
Alisma plantago ALI	Water plantain
Butomus umbellatus	Flowering club rush
Calliatriche stagnalis	Water starwort
Carex riparia	Greater pond sedge
Ceratophyllum demersum	Hornwort
Eupatorium cannabinum	Hemp agrimony
Filipendula ulmaria	Meadowsweet
Iris pseudocorus	Yellow flag iris
Juncus effuses	Soft rush
Lycopsus europaeus	Gypsy wort
Lynchis flos-cuculi	Ragged robin
Menyanthes trifoliate	Bogbean
Nuphar lutea	Yellow water lily
Nymphea alba	Water lily
Nymphoides peltata	Fringed water lily

Potamegetan natans	Floating pondweed
Sagittaria sagittafolia	Arrowhead
Schoenaplectus lacustris	Common club rush
Sparganium erectum	Bur reed
Stachys palustris	Marsh woundwort
Valeriana officinalis	Common valerian
Veronica beccabunga	European speedwell
America maritima	Thrift
Carex flacca	Glaucous sedge
Deschampsia caespitose	Tufted wavy hair grass
Festuca rubra	Red fescue
Juncus effuses	Soft rush
Leontodus autumnalis	Autumn hawkbit
America maritima	Thrift
Carex auta	Slender tufted sedge
Carex flacca	Glaucous sedge
Deschampsia caespitose	Tufted wavy hair grass
Festuca rubra	Red fescue
Juncus effuses	Soft rush

Appendix II Diets

Diet sheet utilised at ARTIS Amsterdam Royal Zoo

Natura Artis Magistra – Animal Feeding Programme

Common redshank

Species Information	FOTO
Common name (ENG): Common redshank **Common name (NL)**; Tureluur ***Scientific name;*** *Tringa totanus* **Habitat** The common redshank is a widespread breeding bird across temperate Eurasia. Breeding The species breeds on coastal saltmarshes, inland wet grasslands with short swards including cultivated meadows, grassy marshes, swampy heathlands and swampy moors. Non-breeding On passage the species may frequent inland flooded grasslands and the silty shores of rivers and lakes but during the winter it is largely coastal, occupying rocky, muddy and sandy beaches, saltmarshes, tidal mudflats, saline and freshwater coastal lagoons tidal estuaries. **Natural diet**: Diet Breeding: When breeding its diet consists of insects, spiders and annelid worms. Non-breeding: During the non-breeding season the species takes insects, spiders and annelid worms, as well as molluscs, crustaceans and occasionally small fish and tadpoles. **Body weight** :	

Diet per day per; Adult		
PRODUCT	**AMOUNT**	**INFO**
High protein sea/wade bird pellets (Lundi Micro®)	2 x per day 2 tablespoons	always some available
Insect pate	Unlimited, (estimated 2 tablespoons)	
Insects like mealworms, buffalo, pinkies etc.	Tablespoon per day	
When raising chicks unlimited insects	Consult vets	
When breeding the diet is supplemented with a general multivitamin-mineral supplement (DK multivit ®)	1-2 gram per 100 gram food	

Preparation & Remarks	Presentation
▪ Food is offered at least 2 x per day but in reality always some available	▪ Food can be presented in food trays.
▪ Pellets and pate are supposed to be 75% of diet	

Enrichment	General remarks
▪ Different types of small fish (smelt), insects or crustaceans	▪ They do have access to smelt, insects and pellets from other species in their mixed enclosure they may not always eat pellets
	▪

Approved for distribution: 7-2024
Artis Zoo; Frank Verstappen

ARTIS AMSTERDAM ROYAL ZOO

Wasit Wetland Centre part of Arabia's Wildlife Centre group Diet

We place 8 food plates with Keema mix and 3 big plates with Micro Lundi, per day. Diet is for approximately 150 birds of 12 species, including 5 common redshanks.

Keema mix: Lettuce, carrot, cabbage, partridge maintenance pellet, calcium, red mincemeat, and mealworms (occasionally).

Keema mix	Lettuce	gr	250
	Carrot	gr	250
	Cabbage	gr	200
	Partridge maintenance pellet	gr	5000
	Dog biscuit*	gr	500
	Red mincemeat	gr	250
	Mealworms (twice a week)	gr	100
	Calcium (sprinkled on)	-	-
	Carnizoo supplement	gr	30

*Dog biscuit: Royal Canin medium Adult.