

# Practical guide for investigating breeding ecology of Kentish plover

*Charadrius alexandrinus*

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## Rationale

The Kentish plover *Charadrius alexandrinus* is a small cosmopolitan wader (body mass about 40-44 g). In the last few years we have developed a suite of methods to investigate its behaviour and ecology in the field. We thought this practical guide may be useful for students and researchers with an interest in small plovers.

Our fundamental motivation in writing this guide is to show that the Kentish plover is an easy species to work with, if one is willing to pay attention to a few potential pitfalls. We hope that this guide will elicit further research. Please feel free to contact us if you have questions and comments, and let us know of any errors. Note that Kentish/snowy plovers have been studied in several countries and by a good range of researchers, and we don't claim that these methods work best.

Many Kentish plover populations are now declining. You need to be sensible about fieldwork, and carefully evaluate the costs and benefits of using a particular method. The last thing you want is to put an extra burden on plover populations - they have a hard time anyway to cope with predators, floods and threats humans are imposing them.

## Essential breeding ecology

Good reviews of Kentish plover (KP henceforward) natural history can be found elsewhere (Cramp & Simmons 1983, Page et al. 1995, Amat 2003), and here we only focus on essential aspects. KPs are migratory in most parts of their range, although populations close to the equator are only partially migrant or resident. They breed on edges of saline lakes and lagoons, and inhabit salt-marshes and sand dunes. Their breeding season lasts for about 2-5 months; populations in the north tend to be single-brooded, whereas southern breeders may double (or triple) brood. Failed breeders often re-nest.

Adult males and females have dimorphic plumage. Males have incomplete black breast-bands, black eye-stripes and a black frontal head bar, whereas these areas are pale brown in females. Males also sport a cinnamon nape and crown. In early breeding season the sexes are easy to distinguish, though the difference in plumage between sexes becomes blurred as the season progresses.

Kentish plovers lay their eggs in a small depression on the ground scraped by the male. The modal clutch size is three eggs, and the eggs hatch after 25-26 days of incubation. Both sexes incubate the eggs; females incubate mostly during the day, while males incubate mostly during the night. The parents lead the chicks away from the nest-scraps within a few hours of hatching. The parents attend, brood and defend their chicks for about 4-5 weeks, but they don't provide food for them. One parent, usually the female, deserts the family and re-nests with a new mate. Thus most KPs are socially monogamous, though both polygyny and polyandry occur in most populations that have been studied to date.

## Searching for nests

Equipment needed: binoculars, spotting scope, mobile hide (see *Appendix 1*) or car.

There are three main methods of nest search:

(i) On foot: potential breeding sites can be screened by walking and searching for nests. Nest scrapes (with or without some nest materials) often indicate the presence of active males. On sand dunes, the plover footprints tend to concentrate around the nests. On salt marsh, it is worth looking for sites that are somehow more elevated from the rest, so that the nest is less prone to flooding. Objects that break monotony of the ground (debris, deep footprints, drift-wood) are often preferred

locations. In fresh (or incomplete) nests the eggs tend to be fully exposed and as incubation progresses the nest material gradually accumulates so that the eggs may be partially covered.

(ii) Spotting incubating parents. The observer should sit on an elevated vantage point (such as a dyke or on a sand bank), or inside a car or mobile hide. Incubated plovers can be spotted by their distinctive white breast, or their contour against the background. Note that sitting plovers can be easily distinguished from incubating ones: the incubating parents appear to have bulging breasts, and they may run off the nest to throw nest materials towards it. The behaviour of non-incubating plovers, however, is more relaxed; they often preen and alternate between sitting and standing.

When using a mobile hide, it is a good idea to move 20-30 m, and then stop and look around using both binoculars and spotting scopes. Make sure you screen the same spot from several angles using different positions – you may be surprised how many nests you miss by superficially looking around. It is worth checking the area very close to the hide, because the plovers may continue incubating until the hide is only a few meters from them. Make sure you screen your path very carefully to avoid pushing the hide over eggs.

(iii) Watching parent(s) returning to the nest. Plovers can be very tolerant of observers inside a car or hide, whereas they are more wary of observers on foot. The flushed parents often run back to the nest in a straight line, although cautious individuals may zigzag, or exhibit seemingly foraging movements whilst gradually approaching their nest. Carefully note the location where the plover disappeared from your sight: often this is a telltale of a nest.

If you flush a small flock of plovers, it is good practice to choose the most anxious plover (the one that does lots of head-bobbing and short abrupt runs), and then follow his/her movements for 10-15 minutes. Bear in mind that if a plover is very anxious, for instance it zigzags for 5-10 minutes in front of you or tries to lure you away; these often mean you are too close to the nest.

***Carry out nest search sensibly, especially if the weather is very cold or hot:*** by keeping the parents away from their nest, you may fatally expose the eggs. A good practice is to work swiftly and efficiently in a given site, and move to a different site as soon as possible to let parents resume their normal life.

## **Finding & checking nests**

Equipment needed: Nest notebook, GPS device, sliding calliper, small jar filled with fresh water.

Once a nest is located, you need to record the essential data (***Appendix 2***). Work efficiently and don't spend more than 5-10 min at the nest: this is NOT the place to celebrate or discuss the latest gossips. Try to leave as few footprints as possible, and don't approach the nest if visual predators (e.g. rooks, shrikes) or humans are around. If you suspect that nocturnal predators (eg foxes, hedgehogs, jackals) may locate the nest using your scent, you should avoid handling eggs and approaching the immediate vicinity of nest in the evening.

We note the nest and egg number on the blunt end of egg using black permanent marker, eg: 34/2. These numbers are often helpful when you only find egg shell remains. People often worry about the harmful effect of marker solvent: we have not seen any evidence of this.

You need to measure egg length and breadth using a sliding calliper (***Figure 1***). Hold the egg horizontally in your palm, and then gently push the sliding calliper downwards and simultaneously pull apart the jaws of the calliper. Record the measurement when the egg squeezes through between the jaws for the first time. Do NOT force the calliper: the eggshell is thin, and can easily break.



**Figure 1.** Process of measuring eggs (from left to right) as illustrated with a hen egg.








To get accurate measurements, you may repeat the process three times and take the median of readings. Note that nothing comes free: this will increase the amount of time you spend at the nest.

If a nest is found after egg-laying is completed, you may need to estimate egg-laying date by floating the eggs in lukewarm water. Use a small transparent jar for this purpose (honey and jam jars work best). Hold the egg firmly on your fingertips whilst immersing it the water: do NOT drop the egg into the jar. The jar should be wide enough to let you hold the egg firmly, and short enough to allow you to remove the egg with your fingers. Do NOT roll (or pour) the egg out of the jar.

We use two methods for estimating the number of incubated days (see also Fraga & Amat 1996).

**(i) Noszály & Székely (1993)**

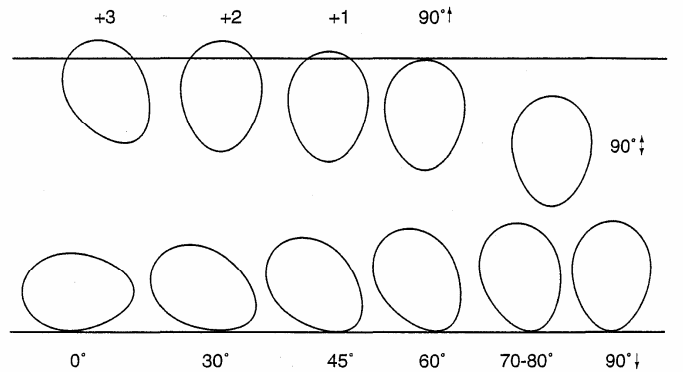
**Table 1.** (a) Variation in floating position of the Kentish Plover egg during incubation. (b) Floation stage off eggs in relation to the number of days incubated. Eggs were measured daily from the date of laying. (Miklapusza records, 1991–1992)

	A tojás pozíciója és hossz tengelyének a vízszintessel bezárt szöge position of egg and angle of its longitudinal axis horizontal	lebegési stádium stage of floating
	az edény alján fekszik lays on the bottom of the dish 0	A
	az edény alján fekszik, a hegyes vég leér, de a tompa vég nem emelkedik fel the pointed edge approaches the bottom, but the blunt edge has not risen < 45	AB
	az edény alján fekszik, a hegyes vég leér, a tompa vég felemelkedik the pointed edge is on the bottom, the blunt edge takes off < 45	B
	az edény alján fekszik, a hegyes vég leér, a tompa vég emelt the pointed edge is on the bottom, the blunt edge erected 45 < és < 90	C
	áll az edény alján, a hegyes vég leér the egg stands at the bottom on the pointed edge 90	D
	lebeg the egg takes off and floats	E
	a tompa vég a felszínre bukkan, a tojás úszik the blunt egg appears on the water surface	F

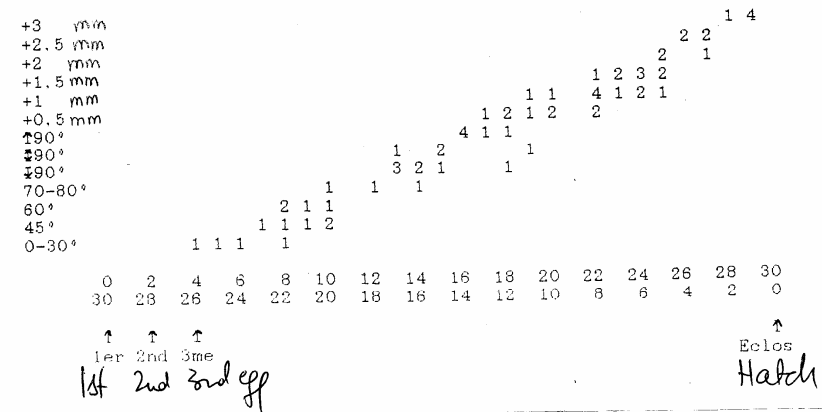
These flotation stages correspond to the number of incubated days as calibrated in Southern Turkey (J Kis, unpublished data). Note that stage F can be anything between 10 days and 25-27 days:

Incubation stage	A	AB	B	C	D	E	F
Number of days incubated (mean ± SE)	0 ± 0	0.8 ± 0.3	2.4 ± 0.4	5.0 ± 0.7	8.0 ± 0.7	10.0 ± 0.8	11.2 ± 1.2
Number of eggs used for calibration	5	7	7	6	3	3	3

(ii) Olivier Pineau (Tour du Valat Biological Station, France) has designed the following chart:



Les différentes positions des oeufs suivant leur degré d'incubation



It is a good idea to write down a concise description of nest location in your Nest notebook (see below), the distances from landmarks (for instance, a bush, grass patch or a peculiar piece of rubbish), and make a sketch. Also, a plastic straw at a sufficient distance from the nest (eg 10 - 15 m) in a standard direction will speed up relocating the nest. Be sensible and remove straws, if you suspect that people (or clever predators) may use them as clues. Straws are not foolproof either: grazing sheep and cattle often have peculiar taste for them.

Nests may be checked at 4-5 days intervals to estimate egg survival. If possible, stay at a distance from the nest and don't handle the eggs at each visit. Near the time of hatching (approximately after the 22nd day of incubation), it is a good idea to check nests daily and tap the eggs gently. To ring the downy chicks in the nest-scraps, you may need to check the nest 2-3 times per day after the eggs

start to peep. Eggs may peep for 2-3 days before the date of hatching, although some eggs may only start to peep immediately before hatching. Near hatching you may also notice minute cracks on the eggshell; these may be sensed by gently turning the eggs between your fingertips.

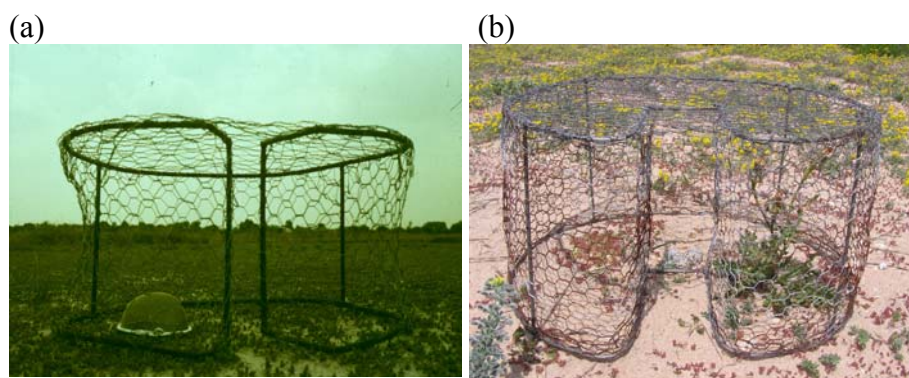
We found it very useful to devote a full (or half) page for each nest in the Nest notebook, so that all data for a given nest can be found there (*Appendix 3*). Bear in mind that incubation often speeds up over the breeding season, so that a nest laid late in the season may hatch a lot faster than you expect.

## Trapping at the nest

Equipment needed: traps, tea-sieve, bird bag, binoculars and/or spotting scope.

Shorebird biologists use a variety of methods to trap plovers, including noose mats, mist-nets and funnel traps. We found funnel traps by far the most reliable and easy method. Not all plovers can be caught; it is best to start with a simple method and get complicated ONLY if it is essential to trap a given individual. Bear in mind that the harder you push the parent the higher the chance it may abandon the nest.

(i) Funnel trap. The diameter of the trap is about 50-60 cm, and its height about 20-25cm (*Figure 2*). Use a local blacksmith to weld a frame from strong wire, and cover the frame with chicken wire of mesh size < 3cm in diameter. All sharp edges of the chicken wire should point outward to avoid injury of the trapped plover.



*Figure 2. Funnel traps.*

1. Place the trap on the nest. You may position the nest in one of the 'corners' of the trap (*Figure 2a*) or in the middle (*Figure 2b*). The former is often safer in terms of trapping the parent, though the parent often takes longer to enter the trap.
2. Hide 50m+ away from the nest to have a good view of the trap entrance. Watch out for humans, livestock herds and predators so they do not damage the trap and/or the parents.
3. If a parent has entered the trap and sat on the eggs, you need to run quickly to remove it from the trap. Be cautious when reaching for the parent inside the trap: you don't want to damage the eggs, the bird or yourself in the process.

In general, females are usually easy to catch early in the morning, whereas for males just before dusk is the best. Do NOT trap at extremely high or low ambient temperatures. If it is essential to trap during the heat of the day, you either (i) shade the eggs by placing a flat object on the top of the trap (dry cow dung just works fine), or (ii) replace the eggs with dummies. Traps should not be left on the nest for excessive periods - the definition of 'excessive' is up to you, but it is rarely sensible to go beyond 20-30 minutes. Instead of forcing your way through, it is better to repeat trapping 2-3

days later.

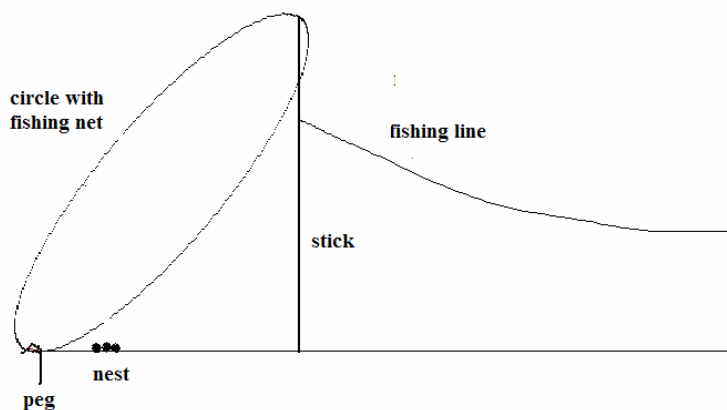
You should NOT trap at a nest that has been incubated for less than 4-5 days. Also, if both parents happen to enter the trap simultaneously, release one of them immediately to let him/her incubate the nest whilst you measure and ring the other parent.

It is possible to trap parents with chicks up to about 2 weeks of age. First, you need to catch ALL chicks in a brood, and carefully place the chicks under a sieve big enough for all chicks. The sieve needs to be fixed on the ground with 2-3 pegs. Second, place the trap over the sieve as you would do with the nest (**Figure 2a**). It is often helpful to cover the bottom 10-15 cm of the trap with some mud (or plant leaves) from the outside to block the direct view of parents of their chick; leave the funnel entrance open, however. This tends to entice parents to enter the trap.

**(ii) Round trap.** If the funnel trap fails, you can try the round trap (**Figure 3**) on a different day. It takes longer to set up than the funnel trap, and you will need more time to retrieve the fishing line. Also, bear in mind that you may need special permission to use this trap.

To make this trap you need a ring (approx 80 cm diameter) of wire or iron (about 0.5 cm diameter). Attach a loose fishing net to the ring using a throat all around - the less visible the net the better. Avoid shiny materials. You will also need a stick (reed or bamboo, about 40 cm), pegs (2-3) to hold the circle firmly on the ground, and fishing line with a reel to hold about 100 m of fishing line.

Set up the trap about 15 cm from the nest so the ring is well above the nest. Attach the fishing line to the stick, and firmly hold the other end of the fishing line in your hide (or car). After the parent has resumed incubation, pull the fishing line with one strong motion so that the ring falls to the ground. Make sure that the pegs are strong enough to keep the trap in its place, and the net is loose enough that the parent will not be injured.



**Figure 3.** The round trap.

## Ringing and measuring

Equipment needed: Metal rings, colour rings, ringing pliers, sliding callipers, wing ruler, spring balance, Capture notebook.

Ringing should follow the general protocols for a given country. Please stick to the rules. A useful reference is Redfern & Clark (2001). Before ringing plovers, especially freshly hatched chicks, you need to get advice from a trained ringer.

**Appendix 4** summarises the main data we advise collecting from plovers. Kentish plovers usually live in saline environments, therefore ring made of non-corrosive material (e.g. steel) are preferred over aluminium rings. If possible, put the metal ring above the 'knee-joint' to reduce corrosion.

Darvic colour rings are quite resistant to sunlight and environment, and we prefer to use overlapping colour rings (as opposed to split rings): white, yellow, orange, red, green, light green and dark blue are easily distinguishable. Avoid black, dark brown and light blue. Countries may have their own colour ringing scheme, although overall, we would not put more than four rings in total on a given plover (3 colour ring + 1 metal ring). Chicks younger than three weeks should be fitted only with a metal ring, and one colour ring at most. The safest ring position we found was to put one ring above and one below the 'knee-joint' on each leg.

The position of rings should be recorded with the following formula:  $XX.XX / XX.XX$  where X indicates a colour (or metal) ring, the full stop marks the position of 'knee-joint' and vertical line divides the left and right leg. Thus the readout is *left above . left below / right above . right below*.

## **Blood sampling**

Equipment needed: sterile needle, glass capillary, Eppendorf tube with Queen's lyses buffer, small piece of tissue paper.

Blood sampling is one of those things you need to see in person. We do our best to describe the methods here, but this may not replace the demonstration by an experienced person. With the emergence of avian influenza, there will be regulations that need to be heeded, on top of the usual legislative, health and safety issues.

From adults, take the samples from their wing vein. First, open the left wing of the plover whilst holding it on its back (if you're left-handed, this may be the right wing). Then push apart the inside wing covers to make the area clearly visible around the wing (brachial) vein. This vein can be spotted as it crosses over a wing-bone. Second, hold a sterile needle flat on the wing, and with a single move puncture the vein; do NOT insert the needle into the vein itself. The rule is to pierce ONLY if you clearly see the vein; do NOT pierce by trial & error: this could easily injure (or kill) the bird. Suck the drops of blood into a capillary - usually only 1-2 droplets come out. Put the tissue paper on the wound and close the wing tightly. Wait a few minutes before releasing the plover.

From chicks, take blood samples from their leg vein. If you look carefully at the tarsus of a chick, you will see the vein goes along the inside of the tarsus. Carefully puncture the vein and collect about 50µl (1-2 droplets) of blood. Make sure that the needle only pierces the vein and does NOT penetrate the bone or the muscles. Place a small piece of tissue paper on the wound to stop bleeding. Empty the content of the capillary into an Eppendorf tube that contains Queen's lyses buffer (Seutin et al. 1991).

The Eppendorf tubes should be carefully labelled: ring number, date, location and sex/age (if known). Samples can be stored at room temperatures, although a refrigerator is preferred.

## **Checking broods**

Equipment needed: binoculars, spotting scope, GPS device, mobile hide or car.

Chicks are precocial so that they often wander over kilometres from the nest. Thus it is a challenging task to establish whether the chicks have fledged or died. We recommend revisiting marked families every 2-4 days, and recording the number and sex of attending parents, and the



number of chicks (*Appendix 5*).

If you come across a brood that has not been marked before, you can estimate the age of these chicks by using a formula (Székely & Cuthill 1999). Since tarsus grows approximately linearly until the age of 25 days (as opposed to body mass that initially drops, and then speeds up), linear estimates appear to be acceptable: AGE (in days) = 2.520 \* TARSUS (in mm) - 48.341

It is a good idea to spend at least 15 minutes with each family to establish whether both parents are still attending the brood, and count all chicks. Brood desertion may not be permanent, so you need a few visits to make certain of desertion by one (or the other) parent.

Broods can be checked at night. The advantage of this is that the chicks are brooded, so that they are easy to count. We also found that capturing chicks at night is less distressing for them than captures during the day. An extra bonus of night-time captures is that next day the parents seem to be less bothered about you than following day-time captures. Work VERY carefully during night: you really need to know your study site and the whereabouts of the plovers to avoid getting stuck or squashing nests and families.

## Resightings

Equipment needed: binoculars, spotting scope, GPS device, notebook, mobile hide or car.

To build up a dataset on the movements of individuals, it is a good idea to note the location of colour-ringed plovers (*Appendix 6*). Every time you spot a colour-ringed individual, we recommend noting down some basic information.

## Notebooks

It is good practice to have three different A5-sized notebooks for fieldwork: one for nest data ('Nest notebook'), one for captures ('Capture notebook'), and a one-page-a-day diary that includes brood observations and resightings. In the diary, it is a good idea to record all activities in the field (e. g. **5 May:** 5.50 start fieldwork; 5.55 trapping at B1/2 nest, 6.15 measuring & ringing female at B1/2..).

\*\*\*\*\* **Disclaimer** \*\*\*\*\*

Please note we will not take responsibility for any consequences of the use (or misuse) of this guide. You need to check the regulations and legislations in your country and where fieldwork is carried out. We did not deal with essential conceptual and practical issues for successful fieldwork (e. g. experimental design, logistics): to overcome these you need to be innovative. Good luck!

\*\*\*\*\*

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## Using a mobile hide in wader research

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Székely, T., Kis, J. & Kosztolányi, A. 2003. Using a mobile hide in wader research. *Wader Study Group Bull.* 103: 40–41.

We describe a mobile hide (or blind) that we designed for making observations of breeding plovers. We recommend it as being particularly suitable and flexible for studying waders in open habitats.

### INTRODUCTION

Researchers often investigate the behaviour and ecology of waders using hides (or blinds). Ideally, these should be mobile since waders (or their nests) may be scattered, and observations may be collected in several locations. For instance, the parents may leave their territory to feed, or the precocial chicks may move to distant areas. For these reasons, research workers often use motor vehicles such as cars, particularly all-terrain vehicles. However, these can be expensive; moreover their chassis can easily overheat and the noise of vehicles may disturb the birds. An additional source of disturbance may arise if researchers get out the vehicle, for instance to catch waders or to check their nests. To overcome the limitations of motorised vehicles, we developed an inexpensive and convenient mobile hide for our studies of Kentish Plovers *Charadrius alexandrinus* in Southern Turkey. For details on the study site and methods see Székely & Cuthill (2000), Kosztolányi *et al.* (2003) and Lendvai *et al.* (2004).

We focus on using the mobile hide in breeding ecology and behaviour, although it might be worth considering applications in studying migratory shorebirds at stopover sites or coastal wintering areas. This hide is probably best suited to studies of waders in open terrain where the substrate is fairly hard.

### THE MOBILE HIDE

The mobile hide had three main components: the frame and accessories, the wheels and the cover. First, the frame was made of 20 × 20 mm square-profiled iron (Fig. 1a). The frame ended in two forks at the front (see Fig. 1.). The lateral branches of the forks were made of 500 × 20 × 5 mm iron (L × W × H). Two small horizontal plates at the rear stopped the frame from sinking in the mud. The observer sat on a wood bench of 1050 × 250 × 30 mm (L × W × H) that was put across the bottom bars. We also fixed a basket of 300 × 170 × 250 mm (L × W × H) on the frontal and lateral middle bars, and 2–4 hooks on the top bars to hold bags, traps, tripods and binoculars. The frame, the basket and the hooks were all painted with rustproof metal paint.

Second, one bicycle wheel of 635 × 38 mm diameter with standard road tires was screwed to each fork so that the frame

stood in an upright position (Fig. 1.). The observer moved the hide by gripping the bottom bars (either lateral or rear), and pushing the hide forward or backward. Before the hide was moved, the bench was pushed forward to let the observer walk.

Third, a hessian (or burlap) cover was made to cover the frame, and attached to it with straps (Fig. 1b). On each side of the hessian cover, there were two window slits; the top slits were used when the observer stood or walked, and the bottom ones were used when the observer sat down. When the slits were not in use, they were covered by roll-down hessian flaps from the inside and strapped to the cover. Three corners of the cover were not fully sewn down to the bottom: one slit of 1700 mm in the rear was left open for the observer to enter the hide, and two slits of 900 mm were left free for the wheels. The total weight of the hide was about 20 kg.

### USING THE MOBILE HIDE

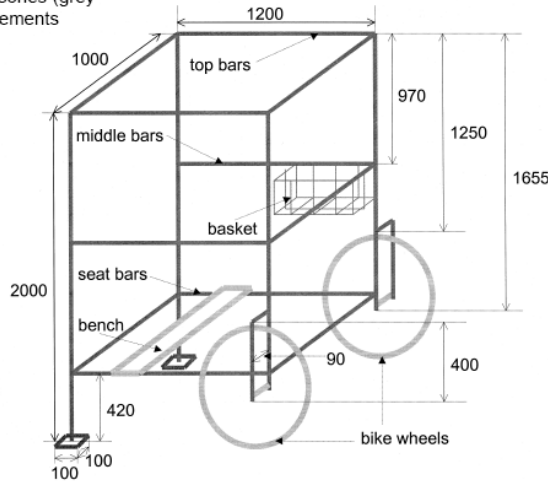
Mobile hides constructed according to this design were indispensable to our fieldwork. They were relatively inexpensive (total cost: about 200 €), and made locally using simple materials. They were very effective, and caused less disturbance (and probably less stress) than motor vehicles. Four hides were spread over the study site so that they were stationed about one km apart. We only used a car to reach the hides, and to relocate them to different parts of the study site as necessary. We used the hides for the following tasks.

First, we searched for Kentish Plover nests and checked nests from the hide (Fig 2). When an incubating plover was spotted we carefully approached its nest, and measured the eggs whilst we stayed inside the hide. Care was taken to avoid trampling the eggs. Plovers were tolerant of the approaching hide; for instance a female only left her nest when the hide was less than one metre from her. After the hide was pushed away from the vicinity of nests, the parents quickly resumed incubation.

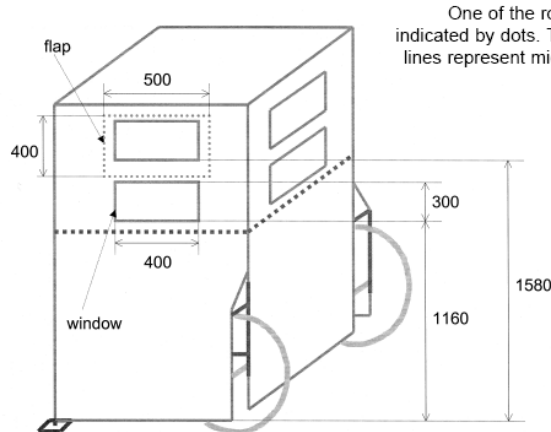
Second, we trapped parents at their nest using funnel traps. The trap was put above the nest, and after the parent went inside the trap, the hide was slowly pushed over the trap and the parent was gently removed from it. Captured plovers were measured and ringed in the hide away from the nest. This procedure was less disruptive than standard nest-trapping when the researcher walks (or runs) to remove the trapped wader.



**Fig. 1a.** The frame of the mobile hide (black lines) and the accessories (grey lines). Measurements are in mm.



**Fig. 1b.** The hessian cover of the mobile hide (grey lines).



One of the roll-down flaps is indicated by dots. The thick dotted lines represent middle bars of the iron frame.

**Fig. 2.** The mobile hide in (a) standing position, and (b) in mobile position. Photos by T. Székely.



Third, we carried out various behavioural observations from the hides (Székely & Cuthill 2000, Kosztolányi *et al.* 2003). Even secretive behaviours, such as brood attendance and courtships, were easy to record, and the plovers appeared to behave naturally. A telescope was mounted on a middle bar using a window-mount (Fig. 2b), and it remained there while the hide was being moved. The mobile hide was particularly handy when the plover(s) under observation waded across mudflats, shallow shores, ditches or thick vegetation, since the observer was able to follow the bird monitoring its behaviour without disruption using the hide. Note that particularly strong winds may make the hide unstable and difficult to manage and manoeuvre.

All things considered, we strongly recommend this mobile hide for wader researchers, since it is more economic and effective than motor vehicles, and causes less damage to the habitat. Unlike hides or blinds that are commercially available and designed for hunters, fisherman or photographers, our hides were easy to move around. Moreover the hessian cover both shades the observer from direct sunlight, and also allows a breeze to blow through the hide and reduce

discomfort in hot weather. If the hide is used in locations where the weather is cold and/or wet, we recommend using a waterproof canvas cover instead of hessian.

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**Appendix 2.** Nest records. Once you've recorded the data in your Nest notebook, you may type in a spreadsheet that looks like this:

Year	Site	Nest ID	Latitude	Longitude	Found date	Laying date	End date	Fate	No. chicks	Clutch size	L1	B1	S1	L2	B2	S2	L3	B3	S3	Observer	Comments	
1996	A	1	59625	89652	420			HAT	3	3	31.7	22.7	E	31.9	22.3	D	32.0	22.1	D	AK		
1996	A	2	59827	89636	420		425	PRED	0	2			AB			AB					TS	
1996	A	3	59324	89638	420		425	PRED	0	2											JK	
1996	A	4	58438	89024	429	427				3			AB			AB				AB	TS	
1996	A	5	58603	88964	420		515	PRED	0	3			D			D				E	TS	

**SITE** – it is a good practice to divide the study site in small units that are refereed as 'sites'

**NEST ID** – give consecutive numbers to each nest for a given site

**LATITUDE** – GPS coordinate; use UTM coordinate system, if possible

**LONGITUDE** – GPS coordinate

**FOUND DATE** – the date the nest was found

**LAYING DATE** – the date of the laying of the last egg (either known or estimated using floatation stages)

**ENDDATE** – last date when the nest was checked

**FATE** – hatched/failed for one reason or the other

**NO. CHICKS** – number of chicks that hatched

**CLUTCH SIZE** - maximum number of eggs

**EGG LENGTH (L1, L2 & L3)** – length of each egg as measured using sliding calliper

**EGG BREATH (B1, B2 & B3)** – breath of each egg as measured using sliding calliper

**EGG FLOATATION (S1, S2 & S3)** – floatation stage of each egg, if laying date is unknown (separately for each egg)

**OBSERVER**

**COMMENTS**

**Appendix 3.** Nest summary. It is often helpful to make a summary table on the last few pages of Nest notebook. This allows you to get updated how many nests you found, when the expected hatching dates are, and how many of nests failed or hatched.

Site: Salt marsh

<b>Nest ID</b>	<b>Laying date</b>	<b>20th day of incubation</b>	<b>Hatching date</b>	<b>Fate</b>	<b>Comments</b>
1	411	501	507	Hatched	
2	412	502		Predated	
3	419	509		Predated	
4	410			?	

Site: Sand dune

<b>Nest ID</b>	<b>Laying date</b>	<b>20th day of incubation</b>	<b>Hatching date</b>	<b>Fate</b>	<b>Comments</b>
101	420	510		Hatched	
102	416	510	513	Hatched	
103	414	504		?	
104	415	505		Predated	

**Appendix 4.** Capture notebook. You may use this table for both your field notes and your spreadsheet file.

Ring	Year	Site	Nest ID	Sex	Date	Time	Weight	Wing length	Tarsus length	Code	Observer	Comments
DH83328	1996	B	12	F	418	550	43.0	118	29.8	XX.MX   XX.WX	JK	
DH83329	1997	C	31	F	418	635	41.6	111	28.7	XX.MX   XX.BX	AK	
DH83329	1996	B	83	F	510	1754	41.8	108	28.5	XX.MX   XW.OX	JK	
DH83329	1999	D	-1	F	605	1834	45.8	112	28.5	XX.MX   XW.WX	AK	
DH83330	1996	B	14	M	418	620	40.6	115	28.6	XX.MX   XW.YX	AK	
DH83331	1996	B	31	M	419	2030	42.0	115	28.6	XX.MX   XG.BX	TS	

RING – metal ring number

YEAR

SITE

NEST ID – same as in Nest file (you may use negative numbers for broods that were found after hatching)

SEX – M, F, J, for adult male, adult female and chick, respectively

DATE – date of capture

TIME – time of capture

WEIGHT – body mass (g)

WING LENGTH – measured by stretching the right wing (only adults and chicks older than 3 weeks, mm)

TARSUS LENGTH – the length of right tarsus (mm)

CODE – colour ring code in the form XX.XX | XX.XX

OBSERVER - ringer

COMMENTS – optional extra information about the bird

Make sure you do not duplicate the same information in different files. For instance, if nest coordinates are registered in the Nest file, there is no point including nest coordinates in the Capture file.

*Appendix 5.* Variables recorded for brood encounters.

Year	Site	Brood ID	Date	Time	Parent	Chicks	Latitude	Longitude	Habitat	Observer	Notes
1999	B3	-1	527	1054	4	3	58177	89026	SALICORNIA	TS	
1999	B3	-1	529	1123	4	3	58107	88682	LAKE	JK	
1999	B3	-1	531	545	4	3	57738	88998	LAKE	AK	
1999	B3	-1	602	2043	4	3	58156	89022	LAKE	AK	
1999	B3	21	606	845	4	3	58022	89160	LAKE	AK	
1999	B3	21	608	1858	2	2	58076	89034	SALICORNIA	TS	
1999	B3	21	609	1633	4	3	57858	89145	LAKE	AK	

YERAR

SITE – see nest file

BROOD ID – brood identifier; negative signs indicate that the brood hatched from a nest we did not find

LATITUDE – GPS coordinate

LONGITUDE – GPS coordinate

DATE – date of re-sighting

TIME – time of re-sighting

PARENT – number and sex of parents (4 – both parents, 3 – only male, 2 – only female)

CHICKS – number of chicks

LATITUDE – GPS coordinates; UTM coordinates are often more useful than other types

LONGITUDE – GPS coordinates; UTM

HABITAT - sensible description of habitat

OBSERVER

COMMENTS – notes & additional details

*Appendix 6.* Resightings of colour-marked plovers.

Year	Site	Latitude	Longitude	Date	Time	Code	Sex	Observer	Comment
1997	C2	58637	88962	430	C2	Mg.XX OW.XX	M	AK	
1997	D	58437	89104	430	D	MO.XX RO.XX	F	TS	
1997	D	58437	89104	430	D	MW.XX RG.XX	M	AK	Courts XX.MG XX.RW
1997	D	58419	89081	430	D	MY.XX gO.XX	F	AK	Former mate of Mg.XX OW.XX
1997	A	58397	89087	430	A	MY.XX RY.XX	M	TS	
1997	C2	58386	89065	430	C2	XX.MG XX.Rg	M	JK	

YEAR

SITE

LATITUDE – GPS coordinates

LONGITUDE – GPS coordinates

DATE – date of re-sighting

TIME – time of re-sighting

CODE – colour ring combination

SEX – sex of observed plover

OBSERVER

COMMENTS – notes about behaviour