

# Gravid female birds cannot be determined by visual inspection

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There has been recent interest in the report of the first bird photographed in flight with an obvious egg inside the body (Shirihai *et al.* 2014). According to Shirihai *et al.* (2014: 218), the photograph shows a Mascarene Petrel 'at sea with a large egg in the uterus', and the swollen area just above the cloaca indicates 'that it is indeed an egg and not an abnormality or growth'. The authors believe this to be 'the first record of a petrel or any other sea- or landbird to be photographed in flight with an obvious egg inside the body'.

However, close scrutiny of the image (Fig. 36, p. 220) reveals that the mass could represent many different structures, an egg being just one possibility. The reproductive tract in birds occupies the dorsal area of the coelomic (abdominal) cavity, with the ovary sited near the cranial pole of the kidney, and the uterus running ventral to the kidneys and emptying into the dorsal aspect of the cloaca (Orosz *et al.* 1997). When an egg forms in the uterus, the pressure on the intestines (which are located ventrally) can sometimes produce a diffuse abdominal swelling (= abdominal distension), which generally is not visible due to the presence of feathers (Fig. 1). Abdominal distension caused by an egg within the uterus is indistinguishable from that caused by conditions such as reproductive disease (enlarged uterus, retained ovarian follicle, egg yolk coelomitis), coelomic effusion, gastrointestinal dilatation, obesity, abdominal wall hernia, or enlargement of any internal organ due to inflammation or neoplasia (Oglesbee 1997). Because petrels are long-lived (Warham 1996), such conditions may be more likely than in short-lived birds.

Petrels lay very large eggs relative to their body size (Warham 1990). However, other birds lay even larger eggs relative to their body size, e.g. kiwis *Apteryx* spp. (Morgan 2008). Gravid kiwis, like most birds, are visually indistinguishable from non-gravid ones (R.



Figure 1. Pacific Parrotlet *Forpus coelestis* with abdominal distension caused by an egg-yolk coelomitis; the abdominal distension is not usually noticeable unless the feathers are soaked or removed (David Perpiñán)

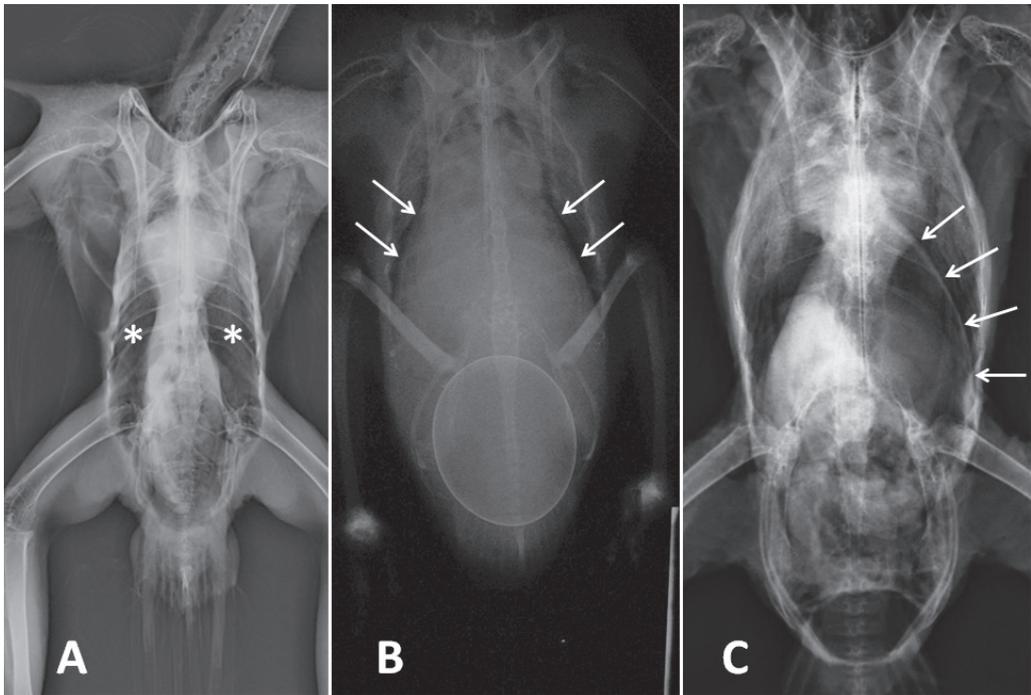


Figure 2A. Ventro-dorsal radiograph: normal anatomy of a Saker Falcon *Falco cherrug* showing the extent of the air sacs (asterisks).

Figure 2B. Ventro-dorsal radiograph: the abdominal organs of this Eclectus Parrot *Eclectus roratus* have been pushed cranially by an egg, compressing the air sacs (arrows).

Figure 2C. Ventro-dorsal radiograph: Salmon-crested Cockatoo *Cacatua moluccensis* with a dilated proventriculus filled with air. The enlarged organ (arrows) occupies part of the air sacs.

Aguilar pers. comm.). A radiograph of a gravid Bonin Petrel *Pterodroma hypoleuca* published by Warham (1990) shows a large egg within the abdominal cavity, but no abdominal distension such as that photographed by Shirihai *et al.* (2014).

Petrels have a highly distensible proventriculus that can store large quantities of food, especially during the breeding season when adults return to feed their chick after being at sea several days (Warham 1996). In these situations, the proventriculus can store food representing up to 25% of the bird's body weight (Schultz & Klomp 2000), exceptionally up to 32% (Warham 1996). There have been reports of gorged birds being unable to fly (Warham 1996). A proventriculus dilated with such quantities of food would create a similar intra-coelomic mass as an egg. However, either a large egg or a large proventriculus is unlikely to cause a markedly distended belly such as that in the Mascarene Petrel photographed by Shirihai *et al.* (2014), as the air sacs usually absorb the 'extra' volume (Fig. 2).

The significant bump observed by Shirihai *et al.* (2014) is also compatible with an extra-abdominal mass, e.g. a lipoma (a fatty lump growing under the skin) or even an abdominal hernia. An example of a bird with a lipoma resembling the Mascarene Petrel under consideration is shown in Fig. 3; this obese Budgerigar *Melopsittacus undulatus* invalidates a statement by Shirihai *et al.* (2014) that 'The swollen area is just above the cloaca, indicating that it is indeed an egg and not an abnormality or growth'. Petrels are well known for storing subcutaneous fat, although this is best known in chicks and pre-migratory individuals (Warham 1996, Schultz & Klomp 2000).

Petrels have been studied for decades. Extensive reviews of their biology (including anatomy, physiology and breeding behaviour) have been published (Warham 1990, 1996). However, a similar finding to that suggested by Shirihai *et al.* (2014) has not been reported, despite many breeding-season studies involving captured birds; instead, researchers have relied on brood patch and swollen cloaca to indicate a breeding female (Warham 1996). That this abnormal finding should be reported for the first time in a very rare petrel is bizarre, especially given that Shirihai *et al.* (2014) suggested it to be a normal egg in the uterus. This claim requires further evidence (radiography, or observation of the bird laying the egg and the distension disappearing, etc.), which the authors were, of course, unable to provide. Even if future studies confirm that Mascarene Petrel is exceptional amongst birds in developing a severe abdominal distension associated with normal egg laying, the bird photographed by Shirihai *et al.* (2014) could still be representative of another condition.



Figure 3. Budgerigar *Melopsittacus undulatus* with fat deposits in the subcutaneous area of the abdomen (David Perpiñán)

Overall, there are many explanations for the mass observed in the image in Shirihai *et al.* (2014), an egg within the uterus being just one possibility, and probably not even the most likely. The presence of a fully-formed egg within the uterus cannot be diagnosed in birds by visual inspection, and even palpation is only partially effective in diagnosing such cases in other avian species (Joyner 1994). Birds, including petrels, do not show such an obvious abdominal distension before egg-laying, and any deviation from this should be properly proven. Shirihai *et al.* (2014) lack any evidence that the abdominal distension they reported was an egg, and they cannot even be sure that the bird was a female. Any conclusions concerning the species' breeding cycle, including laying dates, based on the photograph in question should be treated with much caution. I am commonly presented with captive birds with abdominal distension and the cause can be diagnosed only following palpation, radiography, endoscopy, etc. Ornithologists should consider the many possible explanations for abdominal distension in birds.

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