

BODY CONDITION SCORING PROTOCOL

As a way to assess body condition of captured birds we will use a scoring system to assess the amount of fat and muscle each bird has.

Fat Scoring

The basic procedure for assessing the amount of fat on a bird is described in the paragraph below (taken from DeSante, D.F., Burton, K.M., Velez, P., and Froehlich, D. 2001a. MAPS Manual: 2008 Protocol. The Institute for Bird Populations, Point Reyes Station, CA; emphasis added).

“Subcutaneous fat is a **yellow or orange substance** that is stored just under the skin and is used as fuel for migratory flights and for maintenance during the colder winter months. Fat generally is stored in three discrete areas that usually begin filling in the following order: (1) **the hollow in the furculum (wishbone) just below the throat at the top of the breast muscles**; (2) the hollow directly under the wing, essentially in the “wingpit”; and (3) **the lower abdomen just anterior to the vent area**. The stored fat can be seen clearly through the nearly-transparent skin and contrasts with the dull, dark-reddish color of the breast muscles. It is seen most easily by **holding the bird on its back** while placing the index and middle fingers on the front and back of the bird’s neck, **stretching the head slightly forward** along a line parallel to the body, and **gently blowing the feathers away** from the upper breast to expose the furculum. Then check under the wing and on the abdomen, again by blowing the feathers gently out of the way.”

The figure below illustrates different levels of fat accumulation in the fucular hollow and on the abdomen for a generic small bird. This is not the exact system we are using, but it should give you an idea of the type of fat deposits we are looking for. From: Kaiser, A. 1993. A new multi-category classification of subcutaneous fat deposits of songbirds. *Journal of Field Ornithology*. 64(2):246-255.

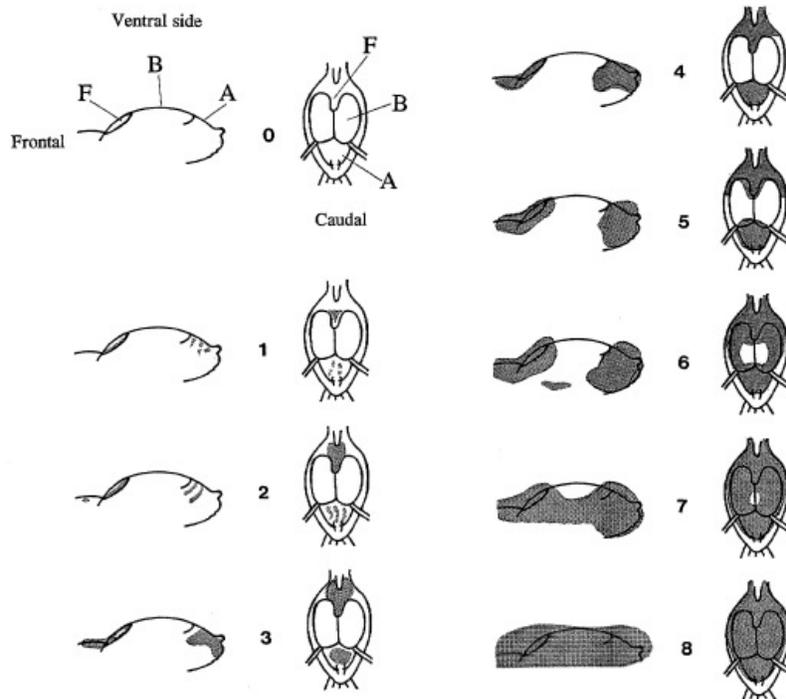


FIGURE 1. Main fat score classes (0-8). F = furcular depression (interclavicular depression), B = breast muscles, A = abdomen, stippled = fat.

Many different fat scoring systems exist, and they are not all analogous—even systems with the same number of categories do not necessarily have the same cut-off points between categories. We are using the fat scoring system that Ray Danner used for his work on Swamp Sparrows (unpublished manuscript).

In this system, the fat scores for the furcular hollow and the abdomen are taken separately (most systems use scores that combine furcular and abdomen). Using the methods described in the MAPS Manual (see above), each of these areas should be assigned to one of the following categories:

Furcular fat scores:

Score	Description
0	No visible fat
1	Fat fills <25% of furculum
2	Fat fills 26–50% of furculum
3	Fat fills 51–75% of furculum
4	Fat fills 76–99% of furculum
5	Fat flush with furculum
6	Fat convex (exceeding furculum)

Abdominal fat scores:

Score	Description
0	No visible fat
1	Light fat under ribcage, none on abdomen
2	Heavy fat under ribcage, none abdomen
3	Fat under ribcage and partially covering abdomen
4	Fat under ribcage and completely covering abdomen
5	Fat on abdomen flush with ribcage
6	Fat convex (exceeding the ribcage)

Pectoral muscle scoring

For muscle scoring, each research team should choose to use one of two systems. Ideally, people should follow the more detailed scoring system developed by Ray Danner (unpublished manuscript). If, however, this system requires too much time to implement then it is OK to use a simpler system (modified from: Gosler, A.G. 1991. On the use of greater covert moult and pectoral muscle as measures of body condition in passerines with data for the Great Tit *Parus major*. Bird Study 38:1-9.). The table below lines up the Danner categories so that they are nested within the Gosler categories to allow conversion from one to the other if necessary.

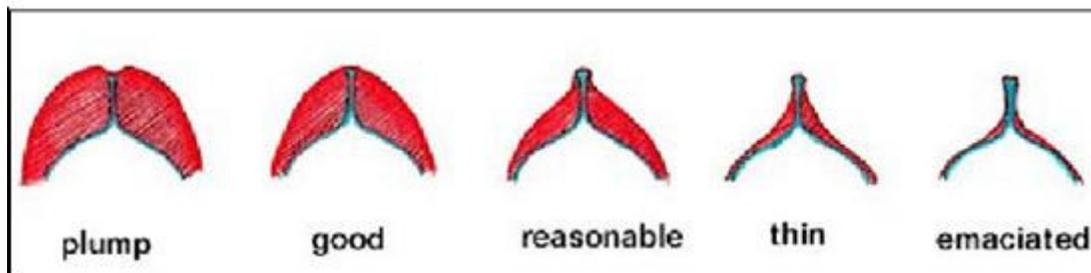
Pectoral muscles should be scored through a combination of tactile and visual inspection. The system is based on examining two related characters, the prominence of keel and the shape of the muscles. Following Ray Danner's approach, hold the bird in a standard banders' grip on its back in the palm of your hand so that you are looking at its belly. Roll your index and middle finger over the pectoralis muscle on either side of the bird's mid-line, to assess its size relative to the keel. Secondly, you can assess the size of the muscle visually by blowing the feathers apart and looking down the long axis of the bird in a manner similar to that described for fat scores (above).

Pectoral muscle scores:

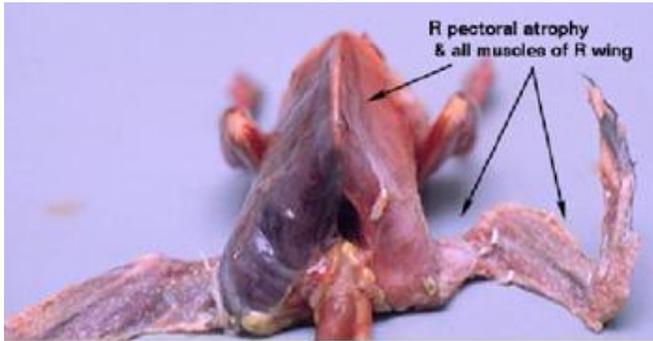
Danner score (preferred)	Description	Gosler score
0	No pectoral muscle	0
1	Muscle concave and not covering all of ribs, keel very prominent (keel sharp to the touch)	0
2	Muscle concave and covering all of ribs (keel sharp to the touch)	0
3	Muscle concave, half way up keel (keel sharp to the touch)	0
4	Muscle concave, almost flush with keel (can feel keel)	1
5	Muscle flush with keel (cannot feel keel)	2
6	Muscle convex (bulging past keel)	2

Note that "concave" here refers to the shape of the muscle with respect to the keel – i.e., if you can feel the keel then the muscle is concave. Further down towards the wings, the muscle will always be concave because the underlying ribcage is concave. In other words, levels 5 and 6 should slope in a simple curve from the keel down under the wings. In contrast, levels 4 and lower will have a sinusoidal "S-like" shape following the contour of the underlying skeleton.

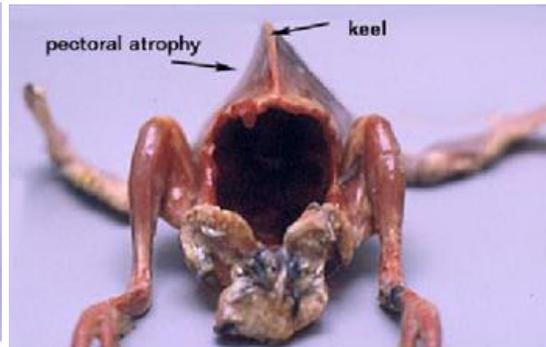
Example pictures of the range of appearances can be seen in these cross-sectional sketches of the pectoral muscles. These pictures are not supposed to correspond precisely to numbers in either scoring scheme, but they would probably score (from left to right) as follows: 6, 5, 3 or 4, 2, 1.



Photographing pectoral muscles on live birds is very hard, but the following pictures of skinned individuals should provide a sense of what you are looking for:



Skinned pigeon. Has one atrophied Pectoral—paler, more concave. Muscles of right wing are also atrophied compared to the left



same pigeon viewed from tail end. Similar to the "reasonable rating" except for the one-sided atrophy



Dead Black-billed Cuckoo. Pectorals are so plump that there is a deep notch over the keel

All pectoral muscle images used with permission of Kit Chubb; more detail can be found at: <http://www.kitchubb.ca/columns/050307a.html>