Introduction to Homework 18: The Enduring Mystery of Loch Ness

Figure 1: Map of Scotland showing the Great Glen and Loch Ness.

Figure 1 shows a map of Scotland[1]. One of Scotland's most dramatic geographical features is the Great Glen. Stretching from Inverness and the North Sea to Oban and the Atlantic Ocean, the Great Glen is a line of valleys and lakes (lochs) that divides Scotland in two.

Scientists believe that the Great Glen was formed by a tectonic fault between 300 and 400 million years ago. In addition to the tectonic activity, glacial erosion is thought to have played a significant role in the creation of the Great Glen.

Geologists believe that the valleys of the glen were enlarged by glacial erosion as recently as 25,000 years ago. At about the same time, the three large lakes (Loch Oich, Loch Lochy and Loch Ness) that span the length of the glen were also formed.

Figure 2: A view of Loch Ness looking down the length of the loch from the North

Figure 2 shows a view of Loch Ness. Loch Ness is a huge lake (23 miles long with an average width of approximately one mile). Loch Ness has the greatest average depth of any lake in the British Isles.

Despite its geographical significance, Loch Ness is best known for the legend of the Loch Ness monster. There is some archaeological evidence (see Figure 4) to suggest that the pre-Christian Pict civilization believed that monsters lived in the lakes of Scotland, but the first written account of a monster in Loch Ness dates from the sixth century of the common era.

In 565 CE, Adamnan (the Abbot of Iona and biographer of Saint Columba) recorded a story of Saint Columba and a lake monster. (Saint Columba was the early missionary who is credited with introducing Christianity to Scotland[2].) In this account, Saint Columba was journeying to Inverness along the shore of Loch Ness when he saw a swimmer being menaced by a monster in the loch. Saint Columba is said to have commanded the monster to depart and it swam away.

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[1] Source: http://www.lonleyplanet.lycos.com/

[2] Sources: http://www.unmuseum.org/lochness.htm and http://www.pbs.org

Until the early part of the twentieth century, Loch Ness was a very isolated location that hardly anyone visited.

Figure 3: A view of the deepest part of Loch Ness, southwest of the ruin of Castle Urquat.

In 1933, the British government built a road that ran along the shore of Loch Ness. After the completion of this road, the number of sightings of strange creatures in the Loch rose dramatically (see Figure 5[3] for a newspaper headline from 1933).

During the early 1930's, interest in the Loch Ness monster rose dramatically and Loch Ness became a popular tourist destination.

Figure 4: A Pictish carving dated to the sixth century of the Common Era. Some scholars have speculated that this carving might represent a lake dwelling monster.

During this period a respected London Surgeon and former officer in the British Army, Colonel Robert K. Wilson (see Figure 7) took a photograph that quickly became the most famous picture of the monster of the loch.


Daily Mail

ONSTER OF LOCH NESS IS NOT LEGEND BUT A FACT"

Figure 5: Front page of the British newspaper the "Daily Mail" from 1933.

Wilson's character and background were regarded as beyond reproach by many and accepted the authenticity of this photograph (see Figure 6) largely on the basis of Wilson's reputation.

More skeptical parties subjected the photograph to the most rigorous tests for forgery or tampering that existed and could find no evidence of any trickery.

For approximately 59 years, the "Surgeon's Photograph" was touted by Loch Ness Monster enthusiasts as clear evidence for the existence of a large, unknown animal living in the Loch.

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[3] Image source: http://www.pbs.org

Figure 6: The "Surgeon's Photo" taken in April 1934 by London surgeon Robert K. Wilson.

In 1993, a man named Christian Spurling revealed that the "Surgeon's Photograph" was a relatively simple hoax that had been concocted by Wilson and the big game hunter Marmaduke "Duke" Wetherall (see Figure 8). (Spurling was Wetherell's stepson.)

Marmaduke Wetherell was a flamboyant British explorer who was active during the 1920's and 1930's. A film-maker and big game hunter, Wetherell had been contracted by the Daily Mirror (a British newspaper) to capture or photograph the Loch Ness monster during 1933.

Shortly after arriving at Loch Ness in 1933, Wetherell found footprints near the edge of the Loch. Without stopping to carefully analyze the footprints, Wetherell announced his findings to the world. Subsequent analysis of the footprints revealed that they were (not very clever) fakes, and Wetherell was publicly humiliated.

According to Spurling, the "monster" was a toy submarine with a carved wooden head on the top.

Figure 7: London surgeon and former British army officer, Colonel Robert K. Wilson.

Figure 8: Marmaduke "Duke" Wetherell.

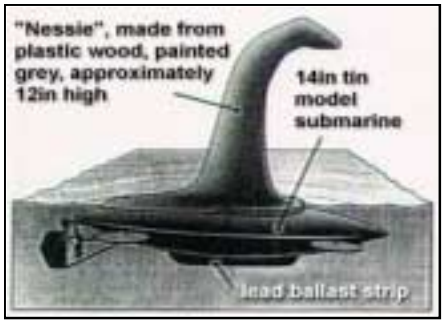

Figure 9: The model used to the Surgeon's

Public interest in Loch Ness and its inhabitants has remained high despite such scandals, and a number of major expeditions have made detailed scientific studies of Loch Ness over the years.

One of the best-known studies was conducted by Dr. Robert Rines in 1972 with funding from the American Academy of Applied Science. In this study, Dr. Rines attached cameras to sonar equipment in order to photograph the creatures that lived in the Loch. Dr. Rines' study produced the two images shown in Figure 10[4].

Figures 10(a,b): Photographs made by automatic cameras of underwater objects in Loch Ness in 1972 during the study led by Dr. Robert Rines and sponsored by the American Academy of Applied Science.

Although these photographs are grainy and difficult to interpret, many people believe that they show the head and body of a long-necked animal (Figure 10a) and the body and flipper of an animal (Figure 10b).

These findings generated a great deal of public and scientific interest, and in 1975 the Loch Ness Investigation Bureau convened a meeting of 200 scientists, journalists and British members of parliament to discuss and analyze the evidence for the existence of a large, unknown aquatic animal in Loch Ness. The group, which included scientists from the Harvard University Museum of Comparative Zoology and the Smithsonian Institution, almost unanimously agreed that the available evidence strongly supported the existence of large unknown animals in the Loch.

Scientific investigations of Loch Ness have continued into the 1980's and 1990's. In 1987, Operation Deep Scan used a fleet of 20 sonar-equipped boats (see Figure 11[5]) to systematically scan the Loch. During this project, several sonar contacts were made with large, moving objects suggesting that something was, indeed, living in the loch (see Figure 12). Sonar evidence is far from conclusive, but the results do suggest that there may be more to the legend of the Loch Ness monster than first meets the eye.

Figure 11: A fleet of 20 boats searched Loch Ness with sonar during Operation Deep Scan.

In Homework 18, you will analyze some of the scientific research that has been done on Loch Ness. In particular, you will study the question of whether or not there could be a monster from the point of view of the ecology of Loch Ness.

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[4] Image sources: http://www.scotland-calling.com/loch-ness-monster.htm and http://www.castleofspirits.com

[5] Image source: http://www.discovery.com

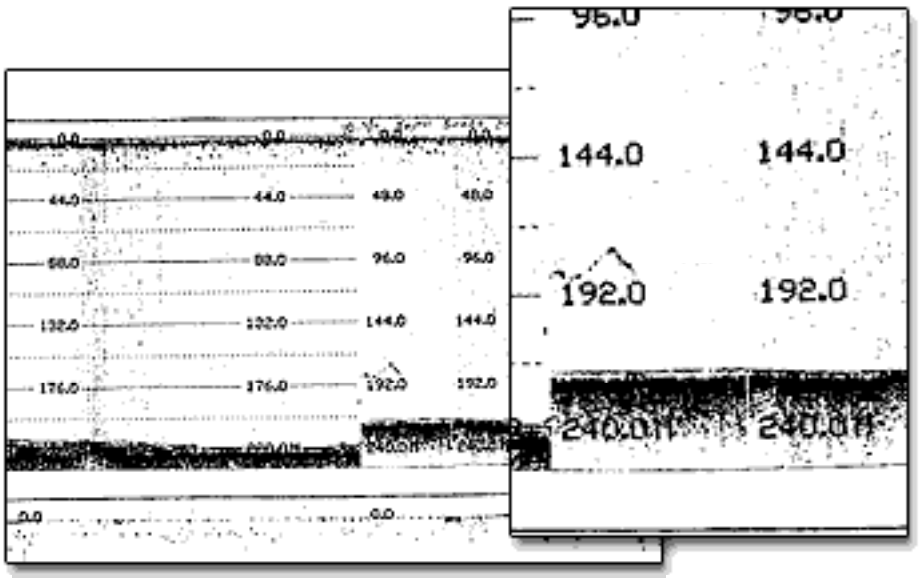

Figure 12: A sonar scan made during Operation Deep Scan, October 9 1987. The arrow shows a sonar signal with a large underwater object.

The idea is to calculate how much food there is in the Loch, and then compare this to the food requirements of large aquatic animals. The methods that you will use are based on the paper:

- R.A. Ryder (1965) "A method for estimating the potential fish production of north-temperate lakes." *Transactions of the American Fisheries Society*, **94**: 214-218.

All of the data that appears in Homework 18 was collected by scientists working at Loch Ness. It is all real, authentic, scientific data, so the results that you obtain will likewise be real, scientific estimates of the amount of food available in Loch Ness. The principal references for this data are the published scientific papers:

- R.W. Sheldon and S. R. Kerr. (1972) "Density of monsters in Loch Ness." *Limnology and Oceanography*, **17**: 746-798.
- J. Kubecka, A. Duncan and A.J. Butterworth. (1993) "Large and small organisms detected in the open waters of Loch Ness." *Scottish Naturalist*, **105**: 175-193.
- D.S. Martin and A.J. Shine. (1993) "The food and feeding relationships of pelagic fishes in Loch Ness." *Scottish Naturalist*, **105**: 149-174.
- A.J. Shine, D.S. Martin and R.S. Majoram. (1993) "Spatial distribution and diurnal migration of the pelagic fish and zooplankton in Loch Ness." *Scottish Naturalist*, **105**: 195-235.

Figure 13: Collecting samples of the fish population in Loch Ness.

The main fish species that live in Loch Ness are arctic charr (Salvelinus alpinus), brown tout (Salmo trutta) and three-spine stickleback (Gasterosteus aculeatus). The density of these fish in different parts of the Loch was measured by Kubecka, Duncan and Butterworth (see Figure 13). These researchers divided the loch into 22 different regions and measured the fish density within each region by trawling for fish (see Figure 13[6]). It is this from data (together with data on the depth distribution from Shine, Martin and Majoram) that the density function given in the homework assignment was created.

[6] Image source: http://www.loch-ness.org/