

WINNING FORMULA CAPSIZE MATTERS

The Eskimo roll is the single most important move in a kayaker's repertoire: getting it right is, literally, a matter of life or death. Here, a paddler and ponderer explain how

PADDLE DONICELY

"It's very common for even the best athletes to find themselves upside-down in white water," says Jana Dukatova, the 27-year-old European and world kayak champion from Slovakia, "so the Eskimo roll is absolutely essential. It's the movement that allows you to right yourself after capsizing. If you can't do it, your only option is to swim, which can be extremely dangerous where it's rocky and rough.

"When you're under the water, first you need to put your paddle up and out of the water alongside the boat. Then you do a strong forward stroke with the paddle, and use momentum from your hips to start turning the boat. Your body comes out of the water first, then your head. People panic and try to get their head out first, and that won't work. When you finish your paddle is back in the basic position across your body.

"On occasions, when the white water is really huge, knowing how to do the perfect Eskimo roll can be a lifesaver."

CANOE COMPREHEND IT?

"The Eskimo roll, also known as the Kayak roll, is the righting of an overturned kayak without exiting it," says Dr Martin Apolin, from Vienna's Institute of Physics. "They say the Inuit invented this technique because they couldn't swim – and who would want to in ice-cold water? For them, this technique was essential to life.

"When your head is underwater, you are stable, because the buoyancy force acts directly over the force of gravity. Any attempt to bring your body upright creates a torque that pulls the body back down (fig. I).

"There are several Eskimo roll techniques, but what physically happens is always the same: the athlete must generate a torque in the opposite direction greater than the downward torque. To do this, the athlete must bring one end of the paddle just below the surface of the water. Into play here come three elements: Newton's third law (of action-equal-opposite-reaction); the torque mentioned above; and the laws of buoyancy.

"The athlete pushes the paddle into the water and exerts a force, or action. The water exerts an equal, but opposite force on the paddle (reaction F_2 in fig. II). Now torque, (M) comes into play, defined as force (F) times distance from the axis of rotation (r): $M = F \times r$. Thus torque becomes greater when the same force is applied at a further distance, and hence why the paddler pushes the paddle as far out into the water as possible.

"The torque generated (M_2) must be larger when coming upright than the existing torque relating to the athlete and the boat (M_1). To make the roll possible, it must therefore apply $M_2 > M_1$. (Fig. II is simplified because the torques and the rotating point change constantly.)

"Now, the force of buoyancy is equal to the weight of the displaced water, and points upwards. Man's density is only slightly larger than water's. Therefore, when the upper body is underwater, the force of buoyancy is almost as large as the weight – in layman's terms, 'weightless'.

"To minimise the force required to rotate, the athlete first turns her pelvis and the kayak automatically follows (figs. I and II). Only at the end of the Eskimo roll does she put her body into an upright position (fig. III).

Roll with it: Kayak champion Jana Dukatova demonstrates how to do a perfect Eskimo roll, a technique which can save a paddler's life

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