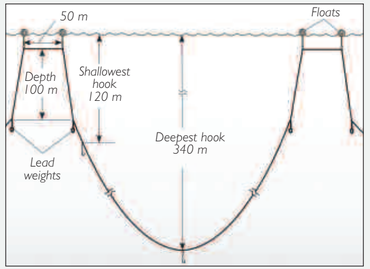
How does the technique work?

The deep setting technique uses the boat's existing gear with some slight modifications. To set the entire line deep, 100 m (328 ft or 55 fa) long sections of the mainline are used as floatline. In other words, the fishing portion of the mainline is suspended by long sections of mainline, weighted down by lead weights at one end and suspended by floats on normal floatlines at the other.

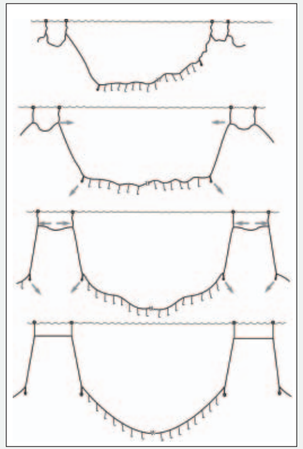
These sections of mainline remain continuous with the fishing portion of the mainline, and are set and hauled in exactly the same way as the fishing portion of the mainline. To avoid tangles between the lead weights of two adjoining baskets, floats are set in pairs between baskets separated by 50 m of blank mainline (no baited branchlines).



Deep longline set

The shape of the line is controlled by using the line setter, boat speed, and line setting timer. The line setter speed is adjusted so that the mainline is paid out at a rate faster than the boat is travelling so that there will be sag in the line. The ratio of the boat speed to the line setter speed determines how much sag will be in the line. This ratio is called the sagging ratio, or SR. To get sag and to set your line deep, a line setter must be used. In the new design, enough extra line is paid out to account for the normal sag plus the desired depth plus the 50 m blank section between floats.

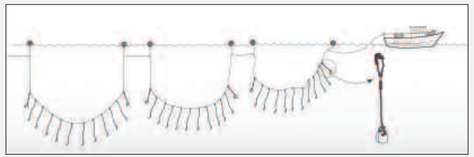
The line setting timer is used to control the depth of the lead weights as well as the distance between branchlines. The timer is set so that each beep indicates that 50 m has been paid out. This is the normal distance between branchlines and between floats and branchlines. To make sure that the lead weights reach a depth of 100 m, the weights are thrown two beeps after the first float is thrown. Then all of the baited hooks are thrown in the normal fashion at 50 m intervals, and then a second lead weight is thrown. Two more beeps after the second lead weight another float is thrown. A 50 m section of blank mainline is then let out to keep the two lead weights from tangling and then another float is thrown. This process is repeated over and over until all of the line has been set.



As the line settles, the lead weights stretch the line as they swing down below the floats, suspending them much like pendulums. As this happens, the fishing portion of the line becomes taut, even though it retains a catenary-like curve shape. The blank sections of mainline between the floats also become taut. The sections of mainline acting as supplementary floatline hang nearly vertically, directly under the floats. The result is that the entire fishing portion of the mainline is suspended in depths ranging from just over 100 m to 300–400 m.

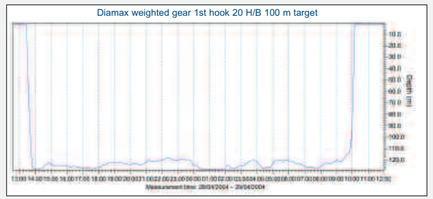
Sequence of events

- First, choose the number of hooks in a basket and the depth for the shallowest hook (for example, 20 hooks per basket fishing below 100 m);
- Now calculate the line setter speed in nautical miles per hour (knots or kn);
- Draw a sketch of one basket and calculate the sagging ratio, SR;
- Calculate the boat speed needed to get this sagging ratio;
- Set the line setting timer so that each beep equals 50 m of line;
- Set the course and speed, turn on the line setter, and throw the first radio buoy;
- After the first radio buoy is thrown, the line setting sequence starts: (beep) float (beep) float (beep) (beep) lead weight (beep) branchline (beep) lead weight (beep) (beep) float (beep) float (beep) (beep) lead weight……
- Repeat this process until all of the hooks have been set.

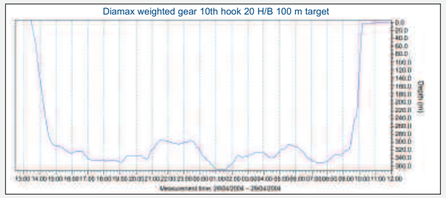


How was this technique verified?

Temperature depth recorders (TDRs) were used during fishing trials to accurately record the shape of the line and the depths at which different hooks were fishing. The TDRs record both temperature and depth over time. During the fishing trials, all hooks fished below 110 m, and down to 340 m.



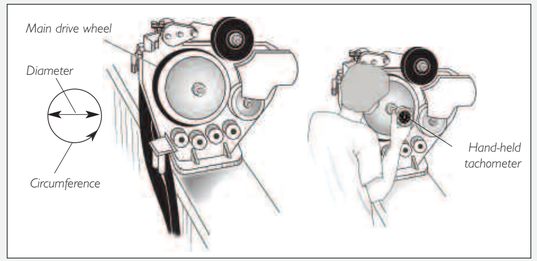
TDR plot for shallowest hook



TDR plot for deepest hook

Calculating line setter speed

Before setting your line you need to calculate the line setter speed. There are many ways to determine the line setter speed. The easiest is if you have a speed readout either attached to the line setter or as part of the setting timer. In this case no calculations are needed. Another way is to measure how much line passes out of the line setter each minute. To do this, run the line setter for one minute while it ejects line into the sea and then pull all of the line back and measure it – or you can use a tachometer (built-in or hand-held) and a tape measure.



If you use a tachometer, you first need to know the circumference of the main drive wheel of the line setter. You can measure this by wrapping a piece of line around the rubber drive belt and then measuring the line with a tape measure, or you can measure the diameter of the main drive wheel with a tape measure and then multiply this number by pi, or 3.14. Either way you need the circumference in metres. Next, run the line setter at full operating speed (with line) and read the RPM off the tachometer. Now, multiply the speed in RPM by the circumference. This gives you the speed in metres per minute. To convert this to nautical miles per hour, or knots, simply divide by 31. There are 1852 m in 1 nm, so a speed of 1 kn is equal to 1852 m per hour. Dividing this by 60 minutes gives you 31. In other words, a speed of 1 kn is equal to 31 m per minute.

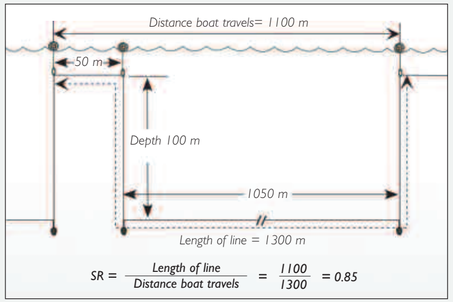
Example: Drive wheel diameter: 0.25 m
RPM: 400
0.25 m x 3.14 = 0.785 m
400 x 0.785 m = 314 m
314 m/31 = 10 kn

$$\text{Line setter speed} = \frac{\text{Circumference of drive wheel} \times \text{RPM}}{31}$$

Calculating the sagging ratio

The easiest way to calculate the sagging ratio, or SR, is to sketch a diagram of one basket of line using the number of hooks and the depth you have chosen (depth can be something other than 100 m). The SR has to be a number less than one. If the boat speed is exactly half of the line setter speed, for example, the SR is 0.5. In normal longline sets, the SR is somewhere between 0.5 and 1.0. When a boat sets the line without using a line setter, the length of line set is equal to the distance the boat travels and there is no sag – the SR is 1. For this technique a line setter must be used.

On the diagram, show the total length of line that will be paid out for one basket. In a 20 hook basket with the shallowest hook at 100 m this would be 1050 m plus 200 m plus 50 m or 1300 m total, assuming that the distance between branchlines is 50 m (21 x 50 = 1050). The distance that the boat will travel for this basket is this distance less twice the depth (in the example 1300 m less 200 m equals 1100 m). Calculate the sagging ratio by dividing the length of line into the distance the boat travels (1100 m/1300 m = 0.85).



Calculating boat speed

To calculate the boat speed needed to set the basket in the sketch multiply the SR by the line setter speed (0.85 x 10 kn = 8.5 kn).

Boat speed = SR x Line setter speed

If more sag is wanted in the fishing portion of the line, this can be accomplished by reducing the boat speed.

Hauling the line

Hauling in the line is done in the same way as usual in longline fishing, with only slight differences. The person unsnapping the branchlines will need to be vigilant when the lead weights come up. However, hauling is generally made much easier because of the tautness of the mainline. There are far fewer tangles using the deep setting method compared with normal longline fishing.

Please let us know if this works for you: fishdev@spc.int

The problem

Even if longlines are set deep to target tuna and day swimming swordfish, many baited hooks still end up in the mixed layer where most bycatch occurs.

Bycatch can be costly as:

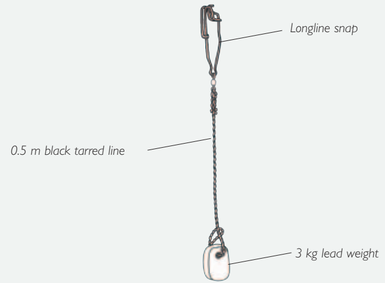
- it takes time to handle unwanted or protected species appropriately;
- baits that are taken by bycatch are not available for target fish;
- gear is lost when sharks bite off hooks;
- there is the potential for fishermen to be injured when handling some unwanted species; and
- it is harmful to the ecosystem, wasteful, and could result in fishery closures.

One solution

Set your longline so that all baited hooks are fishing deeper than 100 m, out of the mixed layer, and out of reach of most bycatch. This will decrease bycatch and could increase target catch and profits.

What gear is needed?

In addition to the existing gear and equipment on your boat, you will need two 3 kg (6 lb) lead weights with snaps for each basket (the amount of line between two floats), one additional float with floatline and snap for each basket, and some additional mainline. This will cost about $3000 (USD) for every 1000 hooks that you set, but this is a one-time-only cost.



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References:

Beverly, S., L. Chapman and W. Sokimi. 2003. Horizontal longline fishing methods and techniques: a manual for fishermen. Secretariat of the Pacific Community, Noumea, New Caledonia. 130 p.

Beverly, S. and E. Robinson. 2004. New deep setting longline technique for bycatch mitigation. AFMA report number R03/1398. Secretariat of the Pacific Community, Noumea, New Caledonia. 30 p.

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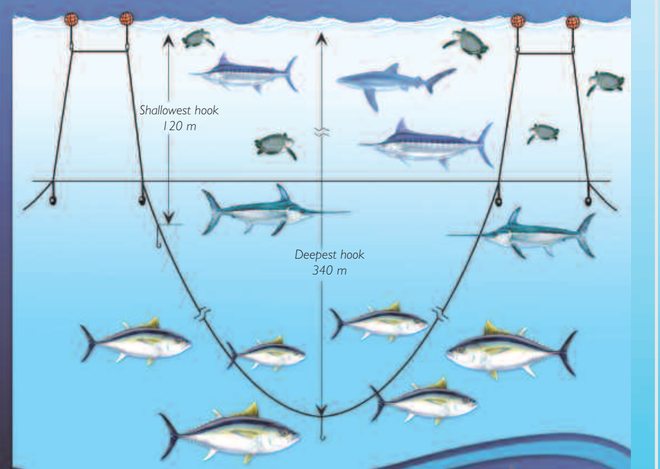
Fish paintings by Les Hata, turtle paintings by Rachel O'Shea and artwork and layout by Youngmi Choi.

SET YOUR LONGLINE DEEP:

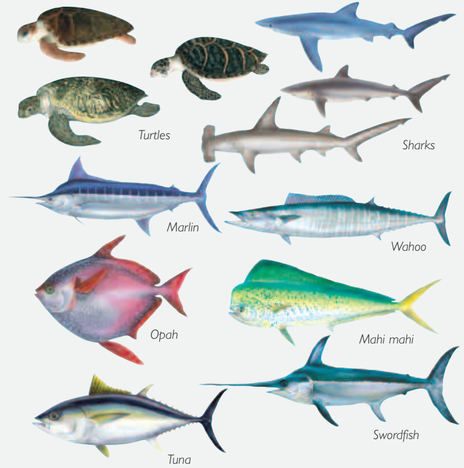
Catch more target fish and avoid bycatch by using a new gear design



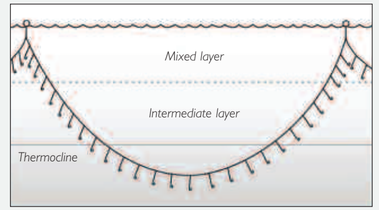
The new gear design is for a longline fishing technique for tuna and day swimming swordfish. It sets all baited hooks below 100 m, out of range of most sea turtles and other bycatch species, but within the best range of the main target species, using lead weights and paired floats and the mainline as long floatline.

Longline fishing facts

Longlines catch target fish (tuna and swordfish), byproduct (wahoo, mahi mahi, opah), and bycatch (unwanted fish, sharks, marlins, and sea turtles).



Normal longline gear fishes in the mixed layer, intermediate layer and thermocline.



Normal longline set

Most longline tuna is caught during the day at depths of 100 to 400 m, below the mixed layer in the intermediate layer, down to and below the thermocline.

Swordfish can also be caught during the day between 100 and 400 m.

Most bycatch is caught in the mixed layer, or in the top 100 m.