

TDRs are for the birds!

BIRD BEHAVIOUR AND DIVING ABILITY

As you are no doubt aware, there are several species of seabird that are very good divers. Have you seen the way muttonbirds swim around, sticking their heads underwater until they see something interesting, then disappear underwater? Some species of muttonbird have been recorded diving to depths of 34 m, while many others can dive to shallower, but still impressive, depths. Even those Wandering Albatrosses with their big wings can make it down a couple of metres, and some species of albatross, such as the Light-mantled Sooty (probably not a species you will see very often) have been recorded diving to a depth of 12 m. Next time you see a Black-browed Mollymawk dive under the water, count the number of seconds that it is down for. Normally it is only around a couple of seconds, but sometimes it can be for much longer.

SINK PROFILES AND SINK RATES

What this means is that it is difficult to keep your baited hooks entirely out of the reach of a hungry bird on the set or the haul. The most important information that we get from TDRs is how quickly your hook is sinking, and therefore how long it is within diving range of seabirds. From the information we get back from the TDRs, we can tell how deep your hooks are relative to the position of the boat, and importantly, how deep they are in relation to the length of your tori line.

Using Time-Depth Recorders we are also starting to discover the sort of depth ranges that hooks are likely to be at in various conditions, using different gear configurations.

You can see the sort of information we can gather using TDRs on the Sink Profile Chart on the previous page.

Weighting the snoods

You will probably have an opinion about the use of weights on snoods. Your opinion is likely to contain the word “dangerous”, and possibly rightly so. As you may already know, the number of accidents in the last few years that have been related to lead swivels has led to many skippers deciding not to use weights at all.

Unfortunately some important things during the haul have been lost: from the seabird perspective, the best method for sinking your hooks fast has gone; and from the fishermen’s perspective, the best way of preventing snoods wrapping around the backbone during a particularly rough soak!

But in some other parts of the world, the use of 60 g lead swivels is standard practice. The bigeye fishery in Hawaii, for example, uses a wire trace and lead weight combination at the hook as standard fishing practice for daylight setting. Using this setup, after some 986 sets there were only 15 seabird mortalities in total. And that was all-day setting!

Having said this, we recognise that the dangers of a large lead weight under tension are real, and recently we have started investigating safer methods of weighting a snood. Two ideas are being developed at this stage. The first of these have used sliding weights that will get left behind when the monofilament is bitten or broken (see diagram, right). The second idea also uses the sliding weight concept, but also spreads the weight using small, sliding lead beads (diagram, left) so that the weight is not concentrated into one or two hard, heavy, and potentially dangerous lumps.



Another approach used by at least one vessel in New Zealand is to use a damper ring on the haul. This is a heavy ring, or weight on a rope, which is slid over a snood and dropped in the water if there is a large shark, or a lively fish on the line. It means that even if there is a line break, the snood is held in the water, and the weight is prevented from flicking back.

Have you had any thoughts about how to tackle this problem? Or do you weight your lines using any other methods? If you have, and you want to share your idea, give the advisory officer a call!

The other ideas pages

We have covered several areas of investigation that we have been making into how to resolve the problem of seabird bycatch. But there are many other methods that have been trialed and tried. Some have promise, others not so much, but all show signs that all over the world people are thinking about how to solve this problem. See what you think!

DYED BAIT S

As silly as it may sound, the practice of bait dying is widely used in some parts of the world, such as Hawaii, as a way of reducing seabird bycatch. Baits in a basket are lowered into a bin containing a non-toxic blue dye during the set (just like a bait-bin strapped to your stern-rail), and then attached to the hooks as normal. The colouration of the baits makes them harder for birds to see, so there are fewer attempts to get the baits, which translates to fewer birds caught on the set.

The colouration of the bait apparently lasts for the whole set, which means that fewer birds are caught on the haul, too. In Hawaii, scientific studies have suggested that the colouration of baits does not reduce the catch-rate of target or marketable fish, but in fact may even increase it! This is because the colouration of the baits appears to make the baits easier for fish to see from below, even though it reduces their visibility to seabirds.

THAWED BAIT S

This is a very well-used technique. Baits that are frozen do not sink as fast as those that are thawed (think about the icecube in a drink—it doesn't sink!), so get your bait out several hours before your set. It only takes a small amount of planning, and is a very effective way of getting your baits to sink faster.

SONIC CANNON

This idea stems from the noise-cannon used in orchards to scare birds away from the fruit. The cannon are gas-powered and produce a loud boom at random intervals from their position on, or near the stern. There are mixed reports of their success, because seabirds can become quickly accustomed to the sound of the cannon. But skippers on the *Daniel Solander* have found that the cannon can be

useful in some circumstances, such as when the boat is turning during the set and baits are not being protected by the tori line, or to clear birds away before the set begins.

In short, though the idea of a sonic cannon may appeal because of its simplicity, the usefulness of the device is probably quite limited.

THE STERN-QUARTER WATER SPRAY

This technique is used during hauling to prevent birds from getting too close to the baited hooks that are being hauled in. The deck-hose or fire hose is propped at the starboard stern-quarter, so that the spray or water jet shoots out to the side of the vessel. This creates a curtain of water that birds cannot see the baits through. The jet of water itself also acts as a deterrent, preventing access to the baits for birds approaching from behind the vessel (the most common bird approach).

ELECTRO-MAGNETIC FIELD DISTORTION

This sounds particularly complicated, and it is. Basically, what this technique tries to do is disrupt the electromagnetic impulses that are used by seabirds to navigate as they fly. The theory is that with these impulses disrupted, the birds will be confused and frightened, and will avoid the area where their navigational sources are being disrupted.

Nice idea. Unfortunately it doesn't work.

NIGHT SETTING

This method is already used by the New Zealand domestic fleet. Birds rely on their eyesight to find food, therefore it makes sense that most of a birds' foraging (looking for food) is done during daylight hours. This does not mean that birds do not feed at night, but activity is much less than during the day. So if you have a choice, choose to set at night. You will avoid most contact with birds, and will keep more of your baits on the hooks where they belong.

On brightly lit nights when the moon is full, or close to it, you will see many more birds around your boat. And because you can see them, it is probably bright enough for them to see your baits. So use a tori line at night too, just to be sure.

DRAG LINES

These are like tori lines, but with the whole thing in the water except for the first few metres. The line is designed so that it can not tangle with the fishing gear, but washers down the length of the line create splashing as they are dragged through the water. The theory is that birds will not land near the fishing line with objects being dragged through the water close by. There is still a lot of research to be done with this method.

LINE GUIDE

The FV *Kariqa* uses a system where a 20 m length of mono is attached to the port-side stern rail during the set. The baited hooks are thrown over this line, and the snood slides down this as it is released, preventing the baits from being dragged back into the prop-wash behind the boat. Because it is mostly the turbulence from the prop-wash that holds the baited hooks at the surface for so long, your baits will sink much faster, and have less chance of catching the eye of a hungry bird.

Why not give it a try?

HOLDING OFFAL

A number of New Zealand vessels are holding offal and used baits on board until the haul is finished. This reduces the attraction of seabirds around the boat, and therefore lessens their chances of getting caught.



As explained earlier in the folder our seabirds do not necessarily stay inside NZ waters. Many species make huge migrations across to South America and the north Pacific. So even if we solved seabird bycatch in all fisheries in New Zealand, this would not mean our seabirds would be safe. Fishing fleets from other countries have reported catching NZ seabirds, so it is important that we ensure these fleets start using seabird friendly fishing practices.

This is one of the reasons DOC, Ministry of Fisheries and representatives of the NZ fishing industry organised an international meeting of skippers and fishing industry reps from the main longline fishing countries. Eighty-one people registered for and took part in the four day Forum held in Auckland in November 2000. Representatives from Australia, Argentina, Brazil, Canada, Chile, China, England, Falklands, France, Indonesia, Japan, Italy, New Zealand, South Africa, Taiwan (China), USA, and Uruguay took part.

The main focus of the forum was sharing of ideas on ways to avoid catching seabirds. Participants committed to doing a number of tasks in their own countries and reporting back at a second International Fishers Forum to be held in late 2002 in Hawaii. The commitments participants made are shown below. If you would like to see a copy of the report from the forum, it is available on the DOC website at:

http://www.doc.govt.nz/whats/issues/fishers_forum.htm

Fishing entity	Commitments from participants
Alaska	<ul style="list-style-type: none"> ➤ publicise names of non-complying vessels and ask regulatory bodies to detail non-compliance in reports ➤ recommend that training workshops for skippers and crew in the use of effective seabird bycatch mitigation measures be provided ➤ revise and improve the seabird bycatch mitigation measures that are currently required ➤ work collaboratively with Canada ➤ organise seminar or panel discussion of stakeholders for Fish Expo 2001 ➤ develop a plan for monitoring seabird bycatch in the halibut fishery ➤ produce and distribute video of effective seabird bycatch mitigation measures tested in Alaska ➤ arrange port visits to disseminate new information ➤ work on retention of black-footed albatross (<i>Phoebastria nigripes</i>) caught on longlines and collect data on captures of this species from other fishing entities in the North Pacific ➤ work with Hawaii to develop a North Pacific Albatross Working Group
Argentina	<ul style="list-style-type: none"> ➤ disseminate information from this forum to government officials ➤ develop relationships with local fishers to educate them about seabird bycatch mitigation measures
Australia	<ul style="list-style-type: none"> ➤ implement Threat Abatement Plan ➤ test underwater setting chute further and disseminate results ➤ develop education strategy ➤ finalise recovery plan for albatrosses and petrels (a draft has been developed and made available for public comment) ➤ recommend reporting of vessels that comply with mitigation regulations ➤ report back from the forum to management advisory committees and industry
Brazil	<ul style="list-style-type: none"> ➤ develop National Plan of Action ➤ select seabird bycatch mitigation measures to be tested, based on information shared at the forum and undertake testing programme ➤ ensure involvement of local fishers
Canada	<ul style="list-style-type: none"> ➤ work collaboratively with Alaska ➤ bring USA fishers to Canada to talk to advisory boards and share information
Chile	<ul style="list-style-type: none"> ➤ present information from the forum to ship owners ➤ propose seabird catch limits for 2001 ➤ attempt to find incentives to encourage voluntary participation ➤ develop a plan to collect seabird bycatch data from small inshore longliners ➤ seek funding from FAO ➤ strengthen links with other South American nations for regional planning

Fishing entity	Commitments from participants
China	<ul style="list-style-type: none"> ➤ disseminate information from the forum ➤ collect data from distant water fleets through fishing companies ➤ seek financial resources from FAO for data collection from Chinese fleets
Falkland Islands	<ul style="list-style-type: none"> ➤ relay feelings and impressions from the forum to industry ➤ pressure Spanish joint-venture vessels to attend next forum ➤ develop a chat web page ➤ share information with the South Americans on seabird bycatch mitigation measures
Hawaii	<ul style="list-style-type: none"> ➤ support continued participation in the Hawaii Pelagic Longline Fishery Protected Species Workshop ➤ test the underwater setting chute ➤ ensure exchange of information with other fleets
New Zealand	<ul style="list-style-type: none"> ➤ continue to upgrade data collection on bycatch in all longline fisheries ➤ continue research and development of line weighting and underwater setting measures in demersal fleet. ➤ ensure compliance with mitigation measures through vessel and skipper contracts in demersal fleet ➤ ensure all new entrants to the tuna fishery are given information kits ➤ include a module on seabird bycatch mitigation in the tuna longline manual ➤ report on the global bycatch of sooty shearwaters (<i>Puffinus griseus</i>) by December 2001
Taiwan	<ul style="list-style-type: none"> ➤ collect more detail for the National Plan of Action ➤ compile educational information for captains and crew ➤ ask government to fund technical experimentation for the distant water fleet ➤ enhance research to investigate level of seabird bycatch ➤ seek further information from other fishery entities
Uruguay	<ul style="list-style-type: none"> ➤ integrate fishers into the seabird bycatch work underway ➤ reward seabird band returns with Mustad caps ➤ gain support from the National Institute of Fisheries for seabird bycatch research ➤ host a similar forum for South American fisheries representatives in May 2001
Southern Ocean	<ul style="list-style-type: none"> ➤ investigate access to CCAMLR observer database as part of the establishment of an international seabird bycatch database ➤ disseminate information from the forum into fishers' journals and magazines ➤ provide relevant material to the European Community to assist prompt action against IUU fishing and to improve practice by vessels of European Community countries in their and external Exclusive Economic Zones ➤ update proposal for the global risk assessment of seabirds in relation to longline fishing, consider approaches to the World Conservation Union (IUCN) & FAO ➤ investigate with Spanish-system fishers the feasibility of adapting vessels to use underwater setting devices ➤ continue to experiment with line weighting regimes for Spanish system ➤ further discussion with Norwegian vessel builders on the development of through-the-hull line setting

Some references that might interest you

The following are articles found in various journals and publications that have not been included in the folder. This is not meant to be a full description of any of these papers or a complete list of papers that I have come across, but more a guide to some good ones, which are quite easily available and have relevance to the tuna fishery. In order to get a hold of these articles, you should go through your local library, using their "Interloan" service. Chances are that there will be a small library charge for the service.

ARTICLES

***Longline Fishing – Where Are We Fishing and For What?
Wade Whitelaw and Robert Campbell (1997)
Asia Pacific '97 Fishing Papers, pp. 21–24***

This article discusses how new technology allows longliners to accurately target specific depths and temperatures using hook monitors (HMs), which are essentially the same as the TDRs which we have been using during this project. This paper describes average depths reached by hooks in various positions in baskets of varying sizes. It also gives tables describing the depth and temperature preferences for different species of tuna and billfish by night and day. This is an Australian paper, so things like gear setup are possibly different, but the paper gives some really interesting facts and figures about tuna fishing. Be warned: the effects of tide, current and weather often make very large differences in where your gear ends up, so the figures in this paper may not be comparable in every situation.

***Horizontal and Vertical Movements of Yellowfin and Bigeye Tuna Associated with Fish Aggregating Devices
Kim N. Holland, Richard W. Brill, and Randolph K.C. Chan
(1990)***

Fishery Bulletin 88(3), pp. 493–505

Using ultrasonic transmitters attached to the fish, yellowfin and bigeye tuna movements were tracked in relation to Fish Aggregating Devices (FADs). This paper provides some really interesting information about where, and how far away tuna travel from FADs. It also details some interesting depth data on where yellowfin and bigeye tuna move to, over the course of the experiment.

Hooking Time and Depth of Longline Caught Southern Bluefin Tuna Observed by Micro-BT

M. Okazaki

CCSBT-ERS/9806/10 (Convention for the Conservation of Southern Bluefin Tuna – Ecologically Related Species paper 9806/10).

This is actually a very interesting paper, despite some translation boo-boos. Again it shows the sorts of data that can be collected using Time-Depth Recorders (they call them Micro-Bathy-Thermographs in this paper for some reason). In any case, the paper details some interesting information on where Southern Bluefin Tuna prefer to feed, and the depths that they appear to prefer at night and during the day.

Southern Bluefin Tuna—What We Know and What We Are Doing

CSIRO Division of Fisheries, Australia

Seafood New Zealand, Nov 1995, pp. 51–54

An excellent little article giving an overview of the major research activities, including conventional and archival tagging (like the TDRs that we use, but stuck on or in the fish themselves), sexing and aging and reproduction of the fish. There is some great information in this article, and in fact the whole November 1995 issue of Seafood New Zealand would be well worth getting hold of: it includes a tuna fishing supplement containing, among other interesting articles, the New Zealand Longline Tuna Fishery Code of Practice 1995. The issue also includes some interesting notes on the seabird conference of the same year, and also the tori line article that is included in this folder.

WEB PAGES

These are sites that may be of interest to you. If you do not have a computer and internet connection of your own, the local library or cyber-café will probably be able to help you out.

Firstly, the Department of Conservation website. From here you can find regular updates of what projects we are working on, and information on why conservation of our native plants and animals is so important.

<http://www.doc.govt.nz>

There is truly a huge amount of information to be found on the internet on the subject of tuna fishing, unfortunately, not much of it comes from New Zealand.

The Ministry of Fisheries website is the place to go and learn more about how the fishing industry is controlled, what the long-term plans are for the industry, who controls what, and information on

everything from the QMS to permits. Probably a good place to get to know, if you want to learn more about how the industry works from the inside.

<http://www.fish.govt.nz>

The seafood industry council is a good place to get an industry perspective of what is happening. This website includes links to the Seafood New Zealand Magazine site.

<http://www.seafood.co.nz>

The Tuna Research and Conservation Centre site has some interesting information about satellite tagging of Atlantic bluefin tuna on the eastern coast of the United States. This is the site that provided the article on satellite tagging and tracking that is included in the folder:

<http://www.tunaresearch.org>

This site also provides an incredibly detailed, full scientific paper (free!) on data recovered from the archival tagging programme so far. Some amazing information here:

<http://www.tunaresearch.org/tagagiant.html>

<http://www.tunaresearch.org/popuptuna.html>

<http://www.tunaresearch.org/popup.html>

For the paper detailing findings using archival tagging:

<http://www.tunaresearch.org/9384.pdf>

The CSIRO tuna pages (based in Australia) give some interesting information about projects occurring a little closer to home.

<http://www.nexus.edu.au/schools/plhs/PLHSTUNA.HTM>

CCSBT Home page (Convention for the Conservation of Southern Bluefin Tuna): among other things this site details the agreement between New Zealand, Australia and Japan.

<http://www.home.aone.net.au/ccsbt/>

For an American perspective on the tuna industry, try the NOAA site (roughly the American equivalent of NIWA here)

<http://www.sefsc.noaa.gov/>

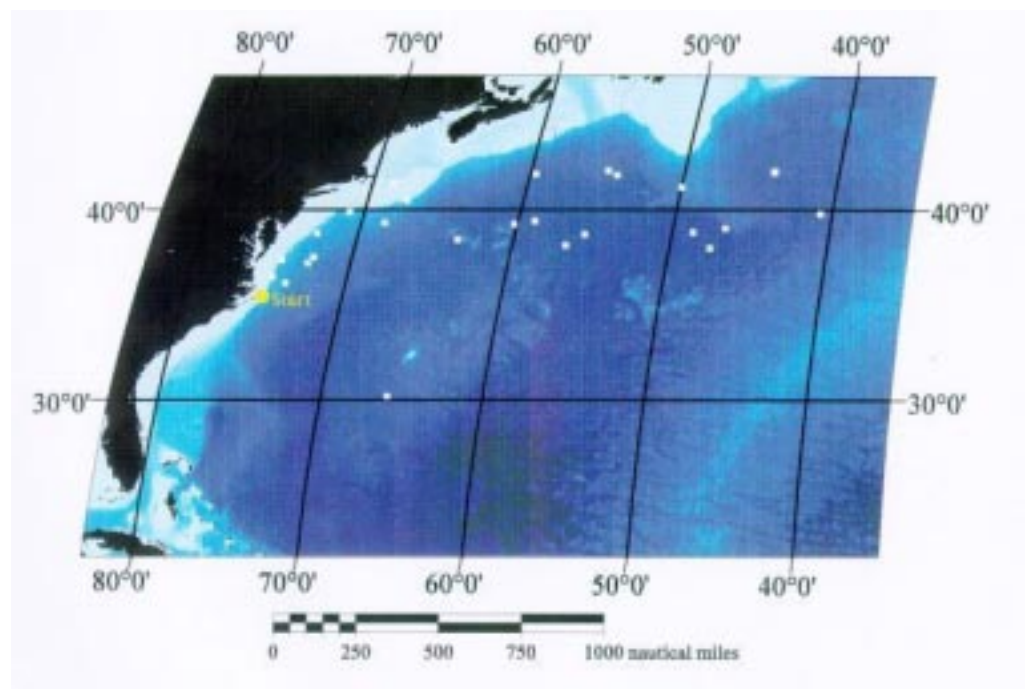


Appendix 1: New Satellite Tags track movements of Atlantic bluefin tuna

(Article from Tuna Research & Conservation Centre)

A new satellite tagging technology has proven that it can help resolve the mysteries of tuna migration at a time when management strategies for these remarkable and commercially valuable fish are in dispute and their breeding population is in sharp decline.

The microprocessor tags, deployed in 1996 and 1997 by scientists from Stanford University, the Monterey Bay Aquarium and the National Marine Fisheries Service, revealed that tunas tagged off Cape Hatteras, N.C., were able to move as far as 1,670 nautical miles in 90 days - and that some fish crossed the line separating eastern and western management zones for the bluefin fishery.



“The results of our work indicate that pop up technology works, and that survivorship is high. The fact that the bluefin spread out in 90 days across the western Atlantic and into the western margins of the eastern Atlantic management zone indicates these fish are on the move,” said Dr. Barbara Block of the Tuna Research and Conservation Center (TRCC), a collaborative effort between Stanford University and the Monterey Bay Aquarium. The findings

appear in the Aug. 4 issue of the Proceedings of the National Academy of Sciences.

The new tags, called satellite pop-up tags, pop free of the fish at a preprogrammed time, float to the surface and beam their accumulated data via satellite to scientists in the lab, revealing where the fish moved and what ocean temperatures they favored.

Giant bluefin tuna, often fetch between \$3,000.00 and \$45,000.00 apiece in the Tokyo seafood market, currently are managed as two separate Atlantic stocks with limited mixing between the western and eastern Atlantic. Using this management strategy, breeding stocks in the western Atlantic have declined by more than 80 percent over the past 22 years, and eastern Atlantic bluefin of similar ages have fallen by 50 percent during the same period.

Western Atlantic tuna are managed under a strict annual quota; eastern Atlantic bluefin have been managed under catch quotas only since 1995, with a 25 percent reduction to be fully implemented this year. "It's now possible - and imperative - to make use of satellite tag technology to determine the extent of transatlantic migrations," Block says. "In that way, management strategies can reflect fish behavior in the real world. With this technology it will be possible to manage giant bluefin tuna so mature breeding stocks could recover in our lifetime." A 1994 report by the National Research Council recommended that fisheries scientists test the stock structure theories to confirm whether bluefin tuna are one or two stocks in the Atlantic Ocean. "We believe that the advanced tagging technologies currently being applied to Atlantic bluefin tuna could provide essential information for resolving questions about the existence of one or two management units," added Eric Prince, chief of the migratory fishery biology division of the National Marine Fisheries Service in Miami, Florida.

According to Block, the satellite tags can be used to provide similar information about other pelagic fish species whose lives are equally mysterious. To date, she and her colleagues have put the tags on bluefin and yellowfin tuna, blue and striped marlins and salmon sharks. What sets the satellite tags apart from other fish-tagging methods is the fact that scientists can recover the data without relying on tagged fish being caught and the tags voluntarily turned in to their labs by fishermen.

Historically, about 13 percent of conventional bluefin tags; have been recovered. In the 1996 and 1997 experiments, data were recovered from 35 of 37 satellite tags. Importantly, this indicates high survivorship of the tag-and-release fish.

The tags were developed in collaboration with Paul Howey of Telemetry 2000, Inc. Tagging took place in a collaboration among the TRCC, the National Marine Fisheries Service and the recreational fishing community off Cape Hatteras. The research was financed by

the National Marine Fisheries Service, the Packard Foundation, the MacArthur Foundation, and the National Science Foundation.

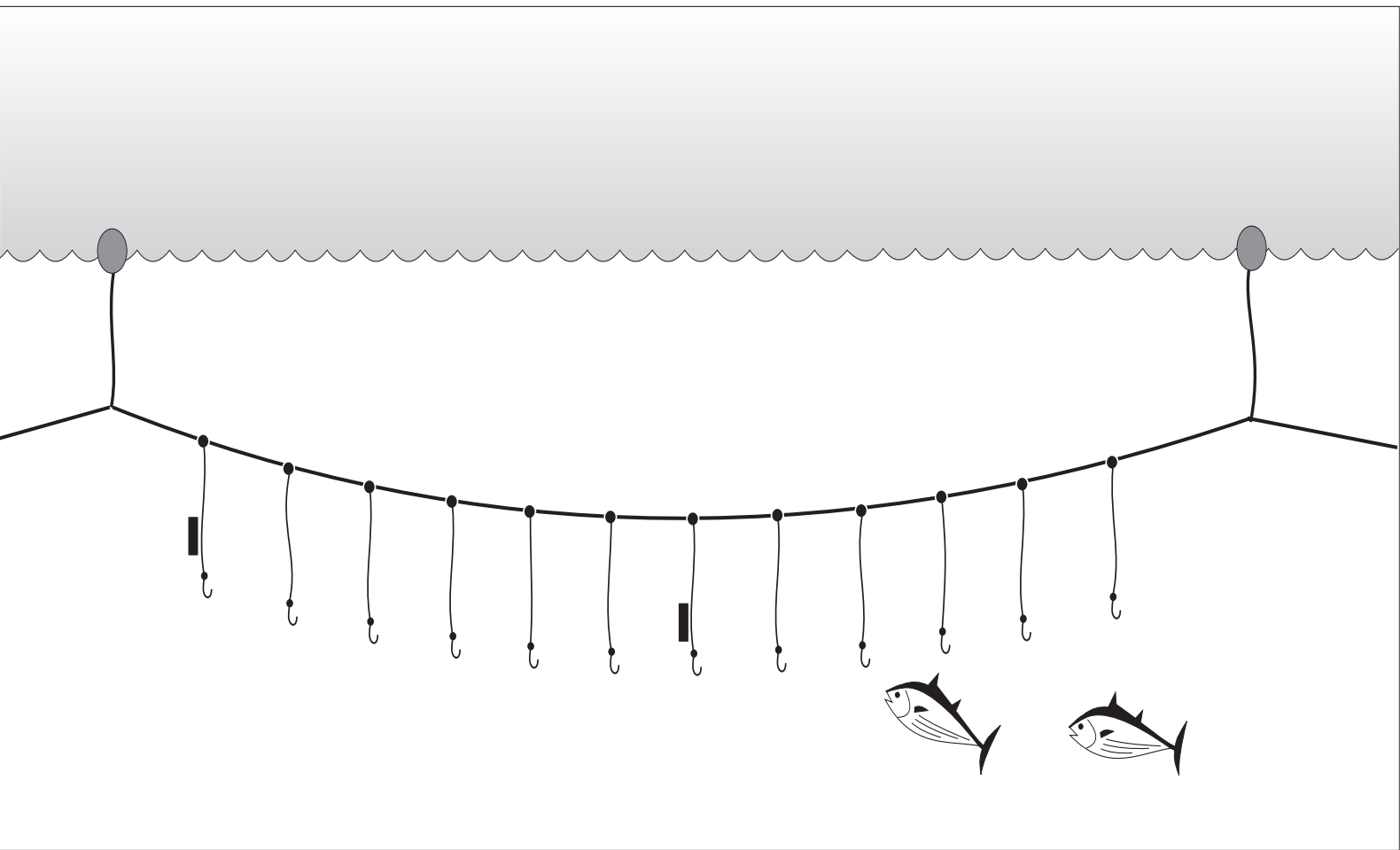
Wild fish up to 234 kg were tagged at Cape Hatteras with techniques developed using captive yellowfin tuna at the TRCC. Extensive work with captive tunas demonstrated that the tags can be attached without harm to the fish, either in the lab or in the field.

Data from the 1997 study found that two out of the 37 bluefin tuna crossed between management zones and four additional bluefin were within 5 degrees longitude of the stock boundary meridian.

Researchers with the TRCC and NMFS plan to tag between 600 and 1,000 giant Atlantic bluefin tuna by the year 2000. This will enable them to rigorously test the stock structure hypothesis.



THE TUNA FISHERS FOLDER



Department of Conservation
Te Papa Atawhai