ICCAT-AOTTP TAGGING-AT-SEA HANDBOOK

FIGURE 1. AOTTP TAGGING ACTIVITY OFF BRAZIL IN 2017

Ultimate objective

The objective of any fish tag-recapture programme is to tag fish, return them to the sea, and to get as large a number of recaptures as possible. To do this one must minimize the number of fish that die after being incorrectly/poorly tagged, and the number of tags that fall out soon after insertion. If fish are not tagged according to the correct protocols then levels of mortality and the rate of early detachment can be very high. Recaptures of tagged fish thus provide information on:

- mortality (if fishing effort and reporting rates are well known)
- growth rates $\left(\frac{\Delta FL}{\Delta t}\right)$
- migration and stock structure

These three parameters are all basic necessities for stock assessment and fisheries management. AOTTP is targeting the three most important (in terms of commercial landings) species of tropical tuna: bigeye (*Thunnus obesus*); skipjack (*Katsuwonus pelamis*); and yellowfin (*Thunnus albacares*). Little tunny (*Euthynnus alleteratus)* and wahoo (*Acanthocybium solandri)* should also be tagged but in lower numbers, ie. Around 10% of the total (*Euthynnus alleteratus*).

Operational goal

The operational goal of the fish tagging activity will ultimately to recapture the tagged tuna after a reasonably long 'time at liberty'. This will depend on the tagging strategy, and the quality of the tagging operations. Although do please note that short-term recaptures, nevertheless, represent valuable information.

Tagging strategy

The ideal strategy is to tag the fish as widely as possible in space, time, and among species and size-groups. Tagging fish close to vessels that are fishing intensively, should be avoided to minimize short-term recoveries. Nevertheless, there are practical, and very real, constraints to consider, e.g. the distribution of tuna, the local abundance of each target species, navigational constraints, administration (fishing permits), and the availability of live bait. Decisions should be taken in coordination with ICCAT-AOTTP, but it is also essential to carefully consider the experience and opinions of skippers and crew.

Safety of tagging operations

Safety at sea

All potential tagging 'platforms', e.g. commercial fishing vessels, recreational angling vessels, traps, and oil rigs all represent very potentially dangerous places to work and utmost care should be taken at all times. Never run on a vessel. Handle the sharp, stainless steel tagging applicators carefully and take extreme care with all chemicals

Hygiene

Fish skin, and the mucous that covers it, are extremely sensitive to damage and infection. It is essential, therefore, to avoid touching the fish with any rough fabrics or nets. Synthetic materials with soft, smooth surfaces should be used at all times. Any surface that will be in contact with the skin of the fish must first also be thoroughly cleaned with an antiseptic solution (bleach, chloro-hexidine), and then rinsed with seawater.

Material and equipment

Tagging cradles

FIGURE 2. EXAMPLE OF WELL DESIGNED TAGGING CRADLE

The 'tagging cradle' (Figure 1) should be the 'work station' when tagging at sea. The number of tagging cradles needed will depend on the size of the boat, but 3 to 4 tagging cradles would be a sensible number for a large (>25m) baitboat.

The tagging work should be carefully planned and organised. Sensible guidelines for each tagging cradle are as follows:

- 2 fishermen with poles.
- 1 fisherman to carefully land the fish, remove the hook and place it in the cradle.
- 1 fully trained technician, assessing the fish, inserting the tags, measuring the fish, recording the data, and returning the fish carefully to the sea.
- A tag block prepared with sequentially numbered tags ready in their applicators.
- Sequentially numbered tag series ready for rapid refills.
- A smartphone (or tablet) with Memento App and fully charged battery.
- An MP3 recorder and a notepad and pencil if necessary.

Tag blocks and applicators

Make sure all the tagging equipment is prepared well in advance. Put the spaghetti tags into the metal applicators and organise them always upside down in the box, registering the ID number of the first tag. You can prepare up to 200 tags in a block. It's important to always have tags prepared in advance. Always finish a tag series before starting a new one.

Tags

You must always know where your tags are! On board the tagging 'platform' be sure to:

- Reserve space in a dry area to stow tags.
- Create a computer file/spreadsheet to keep track of your tags.
- Update the file when tags are used.
- Make continuous cross-checks with the tag-sequences.

For conventional/spaghetti tagging you will need:

- Nitrile gloves
- Chloro-hexidine (disinfectant).
- Submersible paper.
- Pencils.
- Extension cables and power strips.
- Computers and smartphones.
- Power supplies and spare batteries for computers, phones, voice recorders, and cameras.
- Appropriate Memento smartphone template for data upload (refer to ICCAT/AOTTP coordination if in doubt).
- Software and cables for programming electronic tags (ICCAT/AOTTP coordination may do this in advance but check first).

Additional material for internal archival tags:

- Betadine.
- Scalpels with spare blades.
- Sutures (appropriate size).
- Needle holder / scissors.
- Amoxicillin (used as an anti-biotic).
- Hypodermic syringes.

Additional material for chemical tagging:

- Injection gun.
- Oxytetracycline (an anti-biotic but its injection into the musculature of the fish will 'mark' the hard parts at a known moment in time, improving age estimation if the fish is found).

Additional material for pop-up tagging:

- Tag applicators (these are large spikes)
- Assessment tuna viability for tagging

Fish handling

AOTTP will be catching most of the tuna by pole and line/baitboat (although some will be caught with longlines) since post-release mortality is lowest with this métier. Immediately after capture the fish should be placed in the tagging cradle. Always treat the fish with great care to avoid any damage which will compromise their subsequent survival. Never tag any fish which appears unlikely to survive.

REMEMBER TO:

- Pick-up the fish with both hands and never by its tail or gills.
- Keep the fish calm by covering its eyes with a damp cloth/plastic film if necessary. Make sure the fishermen unhook the fish very carefully, and then place it headfirst after tagging back into the sea. Never throw the fish back.

DO NOT TAG IF:

- The fins or eyes are damaged.
- The fish is bleeding substantially from either mouth or gills.
- The fish seems agitated.
- Too much time (>15 seconds) is taken to tag the fish, ie. either removing the hook, inserting the tag, or any other unforeseen mishap occurs.

Remember that in such cases it is always better to use the tag on another fish. If you do, for any reason, tag a damaged fish it is essential to make a note of its state or condition. If there is any question that the fish has been damaged and its survival compromised in any way, always remove the tag. Any fish that is not in perfect condition should not be tagged. Please do not just pull the tag out by force. It must be removed by carefully by cutting the flesh around the tag so that it can be used on another individual.

Tagging

Implantation of conventional/spaghetti tags

The stainless steel applicator (together with its tag) should then be positioned at an angle of 45 degrees towards the tail with the tip directed towards the head (ie. final orientation of the tag should be 'streamlined'), avoiding the hard scales which surround the base of the fin. Place the tuna with its mouth in contact with the 'stop' of the cradle, and implant the tag at the base of the second dorsal fin.

FIGURE 3. EXAMPLE OF A TUNA TAGGED ON ITS LEFT SIDE WITH A CONVENTIONAL/SPAGHETTI TAG

Drive the tag firmly into the fish. The dart should first penetrate the skin and be securely hooked under the pterygiophores of the second dorsal fin. The depth of insertion will vary with the size of the specimen (in a small fish it will be to a maximum of 4cms, but deeper in bigger fish). Fish to be tagged should be out of the water for as little time as possible; ideally less than 15 seconds.

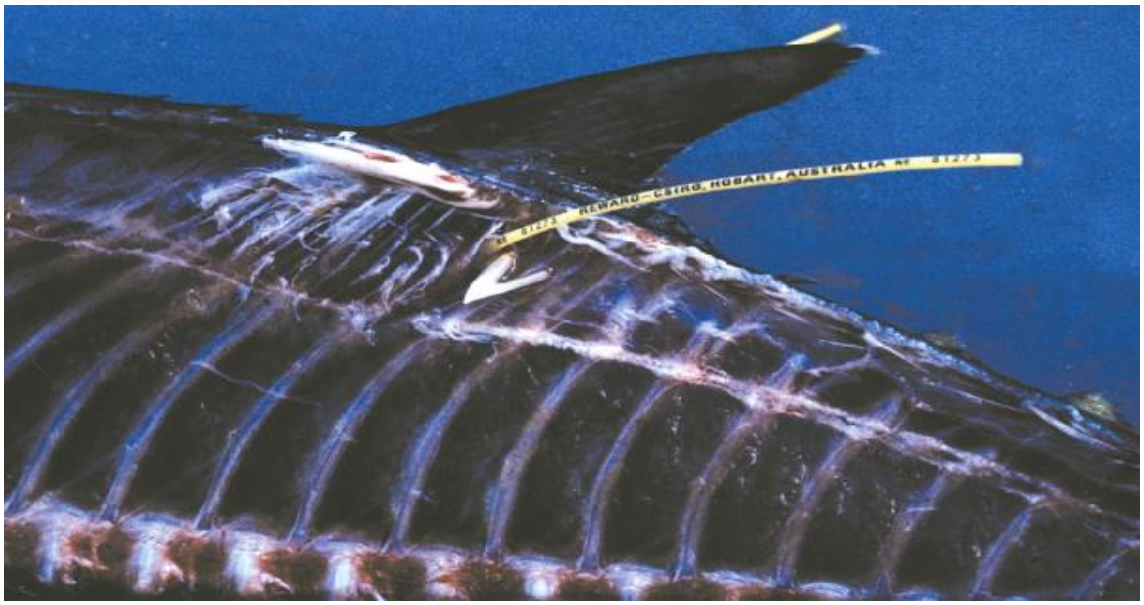


FIGURE 4 EXAMPLE OF DOUBLE-TAGGED TUNA WITH SKIN REMOVED TO SHOW TAG'S DART HEAD LOCKING BEHIND THE PTERIGIOPHORES.

AOTTP tag color protocols and double-tagging

AOTTP will double-tag twenty per-cent of the overall totals, which allows 'shedding rates' to be estimated. This is particularly important for the stock assessment process. When marking a tuna with two tags, always implant the first tag in the left side of the 2nd dorsal fin and the second tag on the right side of the 2nd dorsal.

AOTTP tagging protocols can be summarised as follows:

- Single tagging: insert one yellow tag on the left side of the fish, i.e. the side that faces you when the head of the fish is to your left.

- Double tagging: insert one yellow tag ALWAYS on the left side of the fish, and a second yellow tag ALWAYS on the right.
- Chemical, and/or internal archival, and/or pop-up tagging: ALWAYS insert one orange tag on the left side of the fish (or on the right when tagging with pop-up).

If a fish with a yellow tag is recaptured the location of the recapture and the fish fork length should be recorded. If a fish with an orange tag is recaptured then, in addition to the location and length, the whole fish should be kept (bought if necessary) for detailed biological sampling (age, weight, sex etc.) and checked for presence of an electronic gag.

Length measurement

After tagging any fish, always measure it (see figure 1) to the lowest nearest centimetre remembering to return the fish to the water head-first and carefully.

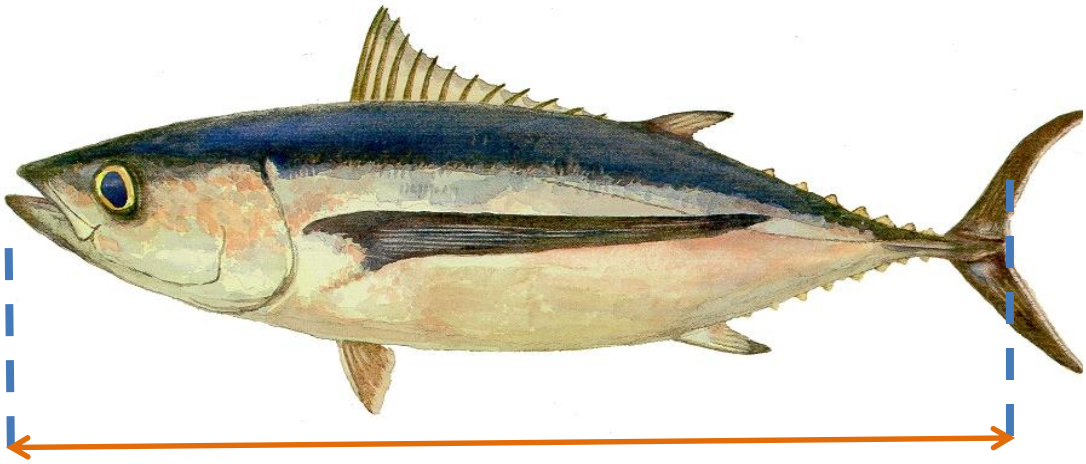


FIGURE 5. MEASURING TAGGED TUNA (FORK-LENGTH)

Implantation of internal archival tags

Precautions

All surgical equipment, gloves and archival tags, should be kept in an anti-septic solution (chloro-hexidine 0.5% dissolved in water for at least 2 minutes). Always use sterilized gloves, or gloves impregnated with anti-septic solution and then rinsed.

The needle and thread used should be specifically designed for medical suturing. A needle with triangular section is better than a round one for keeping steady in the suturing tweezers/forceps. The diameter of the needle should not be too great, and neither should it be easily bent. The thread used must also be of the correct type so as to be absorbed by the fish over time.

Keep the internal/achival tag, together with the tweezers and the scalpel, in an open container of iodine solution. Hold the needle with the tweezers. Ensure you have the hose ready and latex gloves on. Make sure the identification numbers of both the electronic and conventional

tag have been noted. Usually the tags will come pre-programmed by AOTTP Coordination but this should be double-checked.

Using the ventral fins for handling, place the fish ventral side up in the tagging cradle and quickly irrigate its mouth with the salt-water hose. The flow must be adequate to keep the fish 'breathing' but be careful not to apply too much water pressure.

Make sure the fishermen remove the hook carefully.

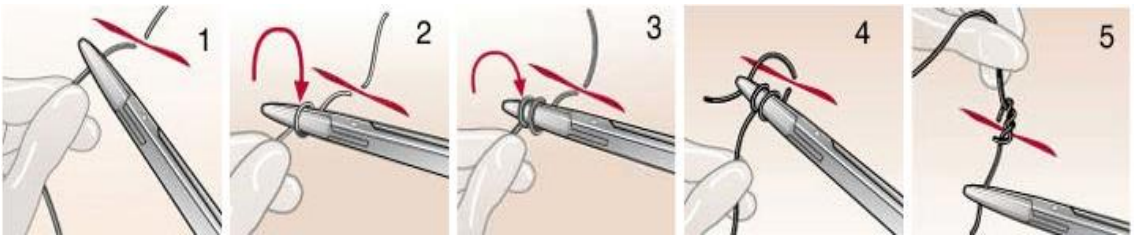
Incise the tuna

Open the fishes' stomach cavity carefully with the scalpel. Do this by cutting a lengthwise slot of circa 3.5 to 4cms (depending on the size of the tag) in length along the smooth part of the stomach. Do not reach too far into the stomach cavity with the scalpel because you will damage the fishes' organs and compromise its ultimate survival. You should only cut through the abdominal muscle until you have reached the stomach membrane. Then, with a finger (your latex gloves should be on) probe through the stomach membrane (peritoneum) until you feel you have reached the stomach cavity. Be careful. If you do not cut sufficiently deeply, when you try to drill into the fish with your finger, resistance will be too hard and you risk crushing the tunas' guts. The slot, therefore, must be large enough to be able to work inside the fish with your finger.

The tag must be introduced at an angle, with the tag body towards the head of the fish and the antenna (or light stalk) towards the tail. The tag should then be fixed between the abdominal muscles and the organs. Again, it is important that the initial cut is sufficiently wide so the tag can be introduced at an angle, enabling it to stick to the abdominal muscle. Remember that the light stalk must protrude from the animal. Once the tag is implanted, we inject 2.5 mL of amoxycillin with a needle-less syringe.

Sewing up the incision

Make one or two sewing points according to the size of incision (ie. two points if the incision is large). Pass the suture from the opposite side to the near side, and make a double knot.



To tie the knot, the clamp is placed on the wire and make 3 turns from the outside to the inside.

Once the first knot is done do exactly the same on the opposite side (clamp the wire, then make 3 turns from the outside to the inside). The knot should be firm but not too tight, to avoid hurting the animal. Once the knot is done, cut the thread, leaving 5 mm on each side. The whole operation should take no more than 1 minute 30 seconds.

Note that it is absolutely essential to prepare by training ashore, preferably on dead fish but suturing can also, for example, be practiced on old towels or similar.

After inserting the archival tag, remember to implant an orange conventional/spaghetti tag on the left side of the animal at the base of the second dorsal fin, measure the fork-length, return the fish carefully head-first to the sea, and record all the data accurately.

Afixing pop-up tags (only tunas > 90 cm FL)

FIGURE 6 POPUP TYPE ELECTRONIC TAG WITH LARGE PLASTIC ANCHOR

AOTTP will be supplying tagging teams with, either miniPAT-348-F from Wildlife Computers, or Sea-Tag 3Ds from Desert Star, or X-Tag PTT-100s from Microwave Telemetry. Usually the tags will come pre-programmed by AOTTP Coordination, and ready to got, but this should be double-checked.

For miniPATs the tag should be in ‘standby’ mode. For Desert Star tags, ensure that the tag is in 'armed' mode. If in any doubt, double-check with AOTTP Coordination as the details surrounding the deployment of each tag vary.

Note the tag identification number before implantation. Soak both the anchor (Figure 5), and the applicator with the disinfectant betadine. Ensure that the light sensor is facing up. Fix the tag to the left side of the fish in the same way as explained above for conventional/spaghetti tags, using the applicator, and getting the anchor to lock into the pterygiophores. For fish between 90 and 100 cm FL the depth of insertion will be 7-8cms.

After tagging, remember also to implant an orange spaghetti tag on the right side of the animal at the base of the second dorsal fin.

Chemical tagging

The oxytetracycline is most conveniently injected into the fish using an 'injection gun' (Figure 6). The gun should first be calibrated to deliver the correct dose (depends on the size of the individual), eg. between 45mg of oxytetracyclin per kilogram of fish.

The injection must be intramuscular, and on the right side of the animal. After the injection implant an orange spaghetti tag on the left side of the fish at the base of the second dorsal fin as normal.

FIGURE 7. INJECTION GUN FOR CHEMICAL TAGGING. NOTE VIAL OF OXYTETRACYCLINE.