

# Ankay Fish Survey Protocol

## Standard Operating Procedure — Belt Transect Method

### 1. Purpose

The purpose of this protocol is to standardize Ankay's reef fish survey method for monitoring fish diversity, abundance, size structure, and habitat complexity at natural reef sites.

This protocol uses a **30 m × 2 m belt transect**, where trained divers record key indicator fish groups observed within 1 m on each side of the transect line. The method is designed to be simple, repeatable, safe for divers, and suitable for long-term comparison across sites and survey periods.

Ankay fish surveys focus on:

- **Key ecological indicator fish** — fish groups that play important roles in reef function.
- **Vulnerable fish groups** — fish that may be affected by fishing pressure or aquarium-trade collection.
- **Fish size structure** — the distribution of fish across size classes.
- **Maximum reef relief** — a simple habitat-complexity measure collected during fish surveys.

### 2. Survey Design

Fish surveys are conducted using a belt-transect method based on established underwater visual census approaches and developed with close reference to AGRRA-style fish survey principles.

Each survey consists of a **30 m × 2 m belt transect**, representing a total surveyed area of **60 m<sup>2</sup>**. The belt extends **1 m on each side** of the transect tape.

After the transect line is laid, observers wait **5 minutes** before beginning the survey. This waiting period allows fish behavior to return closer to normal after diver disturbance.

The active fish survey lasts **10 minutes**. During this time, observers identify and record indicator fish groups passing within the belt-transect area.

### 3. Survey Team Roles

Each fish transect is conducted by a minimum two-diver team. Roles must be confirmed on the surface before descent.

#### 3.1 Navigator (1)

The Navigator is responsible for:

- following the reef contour;
- maintaining the target depth;
- swimming parallel to the shoreline or reef contour when possible;
- maintaining buddy contact with the Line Manager.

#### 3.2 Line Manager (1)

The Line Manager is responsible for:

- following behind the Navigator;
- laying the transect line;
- managing the reel;
- keeping the line as straight and safe as conditions allow;
- avoiding unnecessary contact with coral or fragile organisms;
- retrieval.

#### 3.3 Fish observers (Both)

During the fish count:

- one diver surveys the left side of the line;
- one diver surveys the right side of the line;
- each diver records fish within their 1 m lane;
- fish should be recorded only once.

### 4. Required Equipment

Each survey team should carry:

- 30 m transect tape or survey line
- 2lb weight with a reusable zip-tie
- Underwater slate
- Pencil
- Depth gauge / dive computer
- Compass, if needed
- T-bar with 10cm increments
- SMB / DSMB
- Camera, if available

## 5. In-Water Transect Setup

### 5.1 Starting point

The transect line is attached to the 2lb weight with a reusable zip-tie.

The staff member defines the general starting area based on:

- site plan;
- reef condition;
- safety;
- target depth;
- representative reef habitat.

Avoid placing the transect across:

- large sand patches, unless representative of the site;
- abrupt reef edges;
- isolated reef structures;
- dangerous surge zones;
- fragile coral colonies;
- areas with excessive entanglement risk;
- areas with heavy boat risk.

### 5.2 Laying the transect

The team should:

1. Descend safely and confirm buddy readiness.
2. Confirm target depth.
3. Attach or place the transect line at the starting point.
4. Lay the transect along the reef contour.
5. Maintain a consistent depth as much as possible.
6. Avoid dragging the line across live coral.
7. Once the transect is laid, leave it undisturbed for **5 minutes** before beginning the fish survey at the 30 m mark. The 5-minute waiting period allows fish behavior to return closer to normal after diver disturbance.

## 6. Fish Survey Procedure

### 6.1 Survey area

The survey area is a belt:

- 30 m long x 2 m wide
- 1 m on each side of the transect line

Each observer records fish only within their assigned 1 m lane.

## 6.2 Survey duration

The fish count lasts a maximum of **10 minutes**. Remember the consistent speed taught in training to ensure that surveys always are done at the same speed.

During the 10-minute survey, observers identify, count, and size target fish groups that pass within the belt-transect area.

## 6.3 Recording fish

For each target fish group observed, record:

- fish group or family;
- abundance;
- size class;

Fish should be recorded only once. Avoid double-counting fish that cross from one side of the transect to the other. As a baseline, if it comes from the left side, it is the left side. Confirm with your buddy if unsure, communication in this survey is key.

Fish size is estimated as **total length** using a T-bar marked in 10 cm increments as a visual reference.

Each fish is assigned to one of the following size classes:

- 0–<5 cm
- 6–10 cm
- 11–20 cm
- 21–30 cm
- 31–40 cm
- 40 cm, recorded using the most appropriate 10 cm increment above 40 cm

When estimating fish size:

- use the T-bar for scale;
- estimate conservatively;
- practice before official surveys;
- do not chase fish to estimate size;
- prioritize accurate group identification and counts over perfect sizing.

## 6.4 MRR measurements

After the 10-minute fish count:

1. Review your slate underwater.
2. Do not continue counting fish outside the survey time.
3. Complete maximum reef relief measurements from 5 m to 30 m.

## 6.5 Reel retrieval

After the maximum relief measurements:

1. Confirm buddy status, air, and no-decompression time.
2. Reel the transect line back in carefully.
3. Avoid dragging the line across coral or fragile organisms.
4. Maintain awareness of current, boats, and surroundings.
5. Deploy DSMB.
6. Complete a safety stop if necessary.

## 7. Priority Rules in High-Density Fish Areas

In areas with high fish abundance or high diversity, it may not be possible to record every individual fish with equal precision. When this occurs, observers follow a defined priority order:

1. **Record an accurate fish-group or species list.**  
Record every new target fish group or species observed before focusing on detailed counts.
2. **Record abundance and size of large or rare species.**  
Large-bodied, rare, vulnerable, or fishing-sensitive taxa should be recorded individually whenever possible.
3. **Estimate abundance of other groups.**  
If exact counts are not possible, estimate the abundance of remaining groups as accurately as possible.
4. **Assign size classes for other groups.**  
Where possible, distribute abundance estimates among size classes.

## 8. Maximum Reef Relief

Maximum reef relief is measured as a proxy for rugosity or reef structural complexity. Maximum reef relief also provides a simple way to track changes in reef structure through time.

Maximum reef relief is measured at: 5 m, 10 m, 15 m, 20 m, 25 m, 30 m

At each measurement point:

1. Use the T-bar to define a **1 m radius** around the transect mark.
2. Look for the tallest coral, reef rock, or reef structure within that radius.
3. Identify the lowest point in the underlying substrate nearby.
4. Measure the height difference between the lowest substrate point and the tallest reef structure.
5. Record the value in **centimeters**.

## 9. Metadata

Each fish survey data sheet should include:

- Site name
- Date
- Start depth
- End depth
- Temperature

## 10. Photo Documentation

Photos should be taken when:

- fish identification is uncertain;
- a rare or unusual fish is observed;

## 11. Safety Protocol

### 11.1 General safety reminders

- maintain visual contact with buddy;
- monitor air frequently;
- monitor no-decompression time;
- leave enough time and air for ascent and safety stop;
- be aware of boats;
- use DSMB during ascent when appropriate;
- look and listen before ascending;
- watch for venomous animals;
- avoid entanglement with the transect line;
- maintain good buoyancy and avoid reef contact.

### 11.2 Abort conditions

The survey must be stopped if:

- a diver is low on air;
- a diver is approaching no-decompression limits;
- buddy contact is lost;
- current or surge becomes unsafe;
- boat traffic creates risk;
- visibility becomes unsafe;
- a diver becomes stressed, tired, cold, or uncomfortable;

If you are running low on air, do not try to finish the survey. Rushing through a survey increases the risk of both dive incidents and data errors.

## 12. Data Entry and Backup

Data should be entered as soon as possible after the dive, preferably on the same day.

Post-dive workflow:

1. Clarify uncertain notes while still fresh.
2. Confirm that left-side and right-side observer sheets were merged correctly.
3. Check that no fish were double-counted.
4. Enter data into the Ankay fish survey spreadsheet or database.
5. Back up the file and any photos.
6. Wipe clean the underwater slate for the next survey.

## 13. Quality Control Rules

To maintain consistency:

- use only approved fish group names or codes;
- use only approved size classes;
- do not invent new categories underwater;
- do not guess if identification is highly uncertain;
- use notes or photos for uncertain observations;
- confirm unusual observations with staff after the dive;
- merge buddy data carefully;
- check for duplicate counts;
- keep maximum reef relief values in centimeters.

## 14. Summary of Core Method

Each Ankay fish survey consists of:

- 1 belt transect per survey replicate
- 30 m transect length
- 2 m total belt width
- 60 m<sup>2</sup> survey area
- 5-minute waiting period after laying transect
- 10-minute fish count
- 1 m observer lane per diver
- Target fish groups recorded
- Abundance recorded
- Size class recorded
- Maximum reef relief measured at 6 points
- Buddy-pair data merged into one survey replicate
- Safety prioritized over survey completion