STANDARDISED SURVEY PROCEDURES FOR MONITORING HANDFISH POPULATIONS IN THE DERWENT ESTUARY



Cooper AT, Green MA, Stuart-Smith RD, Valentine JP, Einoder LD, Barrett NS, and Stalker MD



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INTRODUCTION

The spotted handfish (*Brachionichthys hirsutus*) is a small benthic fish endemic to the lower Derwent Estuary, Frederick Henry Bay, northern Storm Bay and the D'Entrecasteaux Channel in south eastern Tasmania (Bruce, Green and Last 1998). It is considered to be vulnerable to extinction due to its highly restricted and patchy distribution, low population density, limited dispersal capabilities and a reproductive strategy of producing low numbers of demersal eggs that are highly susceptible to disturbance.

The recovery program for Spotted Handfish started in 1996 with an initial survey of locations in Frederick Henry Bay, D'Entrecasteaux Channel and the Derwent Estuary (Barrett et al 1996). Only six specimens of handfish were located during this survey, but the locations where they were found were targeted later to try and locate breeding colonies and collect adult fish to develop captive breeding protocols (Bruce et al 1997). The first Recovery Plan was written for the years 1999-2001 (Bruce and Green 1998) and the recovery program has progressed intermittently since then.

Spotted handfish occur primarily on unconsolidated substrate ranging from well sorted coarse sand and shell grit, to areas of fine sand and silt. They have been recorded from depths between 2–30 m but appear to be most common in 5–10 m. Spotted handfish spawn during September and October, females laying eggs on small, vertical, semi-rigid structures. The stalked ascidian, *Sycozoa* sp., provides the primary spawning substrate within the Derwent Estuary, although spawning around seagrasses, sponges, small seaweeds in the genus *Caulerpa* and polychaete worm tubes has been recorded in Frederick Henry Bay and other locations. Reduction in available spawning substrate, egg loss and a general decline in habitat quality caused by introduced marine species or urban, rural and industrial development of the Derwent system may be factors which negatively impact on the species. Due to their highly restricted dispersal capabilities, the ability of spotted handfish to recolonise areas from which they have been displaced is considered to be low.

The introduction of artificial spawning substrate has been trialed at two sites in the Derwent estuary after laboratory trials showed that spotted handfish would use plastic rods as spawning substrate (Green and Bruce 2000). These rods were buried in the sand to form vertical structures on the seafloor that spotted handfish may use as alternative spawning substrate to stalked ascidians (Green and Bruce 2001). The success of artificial spawning substrate in captive breeding trials implies that artificial structures may be used to augment depleted or low quality substrate in the wild. Artificial spawning substrate will be less susceptible to destruction and subsequent egg loss.

Ongoing monitoring of handfish populations and installation of artificial spawning substrates to augment available natural spawning substrates are currently believed to be the most appropriate actions. This manual describes the methods recommended for suitably skilled community divers to do these.

ONGOING MONITORING LOCATIONS

SANDY BAY



BATTERY POINT



SETTING AND RETRIVING TRANSECT LINES

- The transect lines are constructed from 100 m of yellow builders line with small lead weights threaded along its length, positioned every 5 m. Small stainless steel sister clips are at each end to attach weights and connect two or more lines together.
- Two x 100 m lines are connected together and stored on large hand-reels. The lines are set by attaching a 1.5 kg weight and buoy line (with 100 mm diameter foam buoy attached) to one end, dropping the weight over the side of a boat and then playing out the line in a straight line as the boat moves forward (see Figure 1). Another 1.5 kg weight and buoy line are attached to the trailing end and this dropped over the side; the result being 2 x 100m transects being laid end on end, with 100 mm buoys marking the transect ends on the surface.
- Pairs of transect lines are usually set and reset parallel over the survey area, using the surface floats as a guide to setting. Having four pairs of lines on separate hand-reels is best so that when divers have completed searching the transects zone the lines can be wound back onto the hand-reel and then reset if necessary.
- Transects are best set diagonally across the depth gradient such that the divers can be dropped off by the support vessel at the buoy marking the deeper end. Divers then swim down the buoy line to find the start of the transect. They search the transect zone as they progressively swim in to the shallow end of the line. Keeping the transects line set in depths of 12–5 m generally allows enough bottom time and air for two transects to be safely searched by a pair of divers.



Figure 1. Reeling out the transect line behind the boat.

DETAILS OF METHODS — POPULATION SURVEYS

The following scientific information is collected on each transect within the 1.5 m search area:



Spotted Handfish (*Brachionichthys hirsutus*) are recorded individually. Photos of each side of the fish are taken, size in mm, photo number, time and date are recorded on the datasheet. This information allows individual handfish to be identified and an accurate location obtained from the towed GPS by using geotagging.



Stalked ascidians (*Sycozoa spp.*) are counted and recorded by each diver as total per transect.



Northern Pacific seastar (*Asterias amurensis*) are counted and recorded by each diver as total per transect.

- Two divers usually survey 2 x 100 m transects per dive.
- Both divers swim along the transect line using the 1.5 m guide poles to measure if animals are in or out of the search zone. Both divers keep a mental tally of *Asterias sp.* and *Sycozoa sp.* that are in the search zone. One diver is designated photographer and measures the handfish, the other tows the GPS system which is floating on the surface. Of course, tasks can be switched during the dive when appropriate. When a handfish is found the divers signal to each other that a fish has been found. Put the 1.5 m guides on the bottom to mark the position, get the data sheet out and prepare for photography.
- At this point it is best that both divers record current tallies of *Asterias sp.* and *Sycozoa* sp. on their respective sides before processing the handfish (when the fish is processed and searching resumes ,divers start counting again until the next handfish or the end of the transect).
- The diver attached to the GPS pulls the tow line in so that the system is floating directly overhead and the other diver starts photography (see later).
- If a handfish is found outside of the search zone it is still processed in the same way but "NOT" (Not On Transect) is clearly marked on the data sheet next to other details for this fish.
- At the end of the transect divers record their final count of Asterias and Sycozoa.

DETAILS OF METHODS — CONT'D

- Ideally, 40 transects should be surveyed at each location (Sandy Bay and Battery Point), consisting of 20 lots of 2 x 100 m transects laid end on end.
- Figure 2 shows a diagrammatic layout of 2 transects laid end to end.
- Between the two divers, there should be: 1 datasheet, 2 guide poles, 1 set of calipers, at least 1 camera and 1 towed GPS.

TIPS:

- It is important to make sure the time on the camera is exactly the same and the time on the GPS, adjust the camera time if necessary.
- Make sure the GPS is turned on before putting it into the housing and then turn it off after the dive to conserve battery and stop it making tracks that are not on the transect.



Figure 2. Stylized representation of survey technique

DATA SHEET PROTOCOL

- Figure 3 shows an example of an appropriate underwater datasheet looks like.
- Make sure all left column fields are completed pre-dive.
- When recording counts, use tally lines in groups of 5 or groups of numbers with commas. Make sure to underline whole numbers (e.g. avoid 32 being interpreted as a 3+2) and take particular care with written 11 (eleven) as this looks identical to two tally strokes.

Date:	Divers:		Ha				
		No	Time	Depth			
	Ascidians:	1					
		2					
Site:	Asterias:	3					
		4					
Transect No:	Comments:	5					
		6					
Camera No.		7					
		8					
GPS No.		9					
		10					
Date:	Divers:		Ha				
		No	Time	Depth			
	Ascidians:	1					
		2					
Site:	Asterias:	3					
		4					
Transect No:	Comments:	5					
		6					
Camera No.		7					

Figure 3. Underwater spreadsheet layout

PHOTOGRAPHING AND MEASURING HANDFISH

- Photographs need to be clear, well lit and in focus. It is better to take a well focused photo which can be cropped later rather than try and take a close up shot that that ends up unfocussed. Ensure that bits of weed or other debris are not in front of the fish during photography. Try and take pictures of the full lateral sides (see examples below).
- Take at least one good photo of each side of the handfish and record the photo numbers on the datasheet.
- Ensure the towed GPS is directly over the handfish location and maintain position during the photography. The diver with the GPS can record water depth while the other diver takes photos.



- Measure the total length (tip of nose to tip of tail) of handfish in millimeters using calipers or a plastic ruler placed close to the fish.
- Take the pictures first before attempting to measure. Occasionally handfish will rapidly swim away a short distance when disturbed. If this happens make sure the other diver understands what has happened and then very carefully start to search. Often the fish will dart directly beneath a diver, so make slow and careful movements, particularly be mindful of what is under your fins!



Measuring the total length of a handfish.

EQUIPMENT LIST

- 100 m transect lines on hand-reels.
- Weighted buoys on rope (min. 10 m long), 2 for every hand-reel of lines.
- Additional rope with shark clips (to allow for varying survey depths)
- GPS Preferably 'Garmin 72H' or alternate model which has the ability to record tracks.
- Floating GPS housing (see methods for GPS set up), one for every pair of divers
- Camera with underwater housing, one for every pair of divers
- Slates, pencils and waterproof datasheets
- 1.5 m guide poles (1 per diver)
- Small ruler or calipers





ARTIFICIAL SPAWNING SUBSTRATES—CONSTRUCTION

MATERIALS

- 1 mm thick PVC sheeting (1.2 x 2.4 m)
- 3 mm diameter PVC welding rods
- PVC Glue

METHODS

- Punch 5 cm diameter circles out of 1 mm thick PVC sheet using drill press or similar.
- Drill 3 mm hole through the centre of each disc.
- Cut PVC rods into 20 cm sticks.
- Push one disc onto a stick (approx. 1/4 of the length of the stick) and glue in place.



PLANTING TECHNIQUE

- 200 artificial substrates per transect line, in array shown in Figure 4.
- Divers swim out the 100 m fiberglass tape to mark the transect underwater and use weighted floats to mark the start and end of the line. GPS coordinates are recorded at the start and end of each transect line.
- Substrates are planted at 1 m intervals along both sides of the transect line at a distance of 1 m from the line.
- Substrates should be planted using a garden trowel so avoid disturbing excess sediment and buried with approximately 1/2—1/3 of the stick visible (see diagram). The trowel is pushed into the sediments and pulled to one side to open up a hole, the artificial substrate is pushed into the hole and the trowel is removed, letting the sediments fall back into place.
- Divers should work into any current so that disturbed sediment does not reduce visibility.



ARTIFICIAL SPAWNING SUBSTRATES—PLANTING ARRAY



Figure 4. Stylized representation of artificial substrate planting layout.

EQUIPMENT LIST:

- 100 m fiberglass tapes x 2
- Weighted Buoys on rope (min. 10 m long) x 2
- A GPS for marking the position of deployed artificial substrates
- Additional rope with shark clips
- Catch bags x 2 (no mesh)
- Artificial substrates (x 200 per site)
- Garden trowels, 1 per diver

ADDITIONAL INFORMATION

MAKING THE GPS HOUSING

*The following model is not essential, however it has been designed to allow for minimum weight and drag for the diver and maximum stability.

MATERIALS

- 30 cm (12 in) fishing buoy—cut in half
- Waterproof case e.g. Pelican case (1050 Micro case fits a Garmin 72H)
- Waterproof glue
- Rope (5mm)
- Hot knife and/or chisel

METHODS

- Cut out a cavity into the flat side of the buoy. Make sure the cavity is only just big enough to fit the Pelican case.
- Tie a short length of rope with a clip on one end to the buoy. Glue the Pelican case in with waterproof glue.



Under side of floating GPS housing



Top side of floating GPS housing

SETTING UP THE GPS

[Note: not all GPS devices have the ability to track]

• Set the GPS so that it automatically starts tracking when switched on and set the tracks so that the device records coordinates every 15 seconds.

If using a Garmin 72H then:

Menu —> Tracks —> Menu —>Setup Track Log —> Recording: Stop when Full, Record Method: Time, Interval: 00:00:15.

• Be sure to turn the unit off in between dives so that the memory doesn't become full of redundant points.



DOWNLOADING THE GPS POINTS

• If using a Garmin 72H, 'MapSource' or another similar program which can load maps, make routes, view waypoints and tracks will need to be installed on your computer.

•	'Transfer' -> 'Receive from device' -> 'Find device' ->
'W	hat to Receive' —> Select all (as shown)



• Once the download has finished, a map will appear with tracks of where the GPS recorded. In the left column, select 'Tracks' and you will be able to see where the Device recorded the tracks on each dive. Double clicking on each Active Log will provide individual points with the date, time, latitude and longitude.

• Matching the times on the datasheets to the times in the track log will provide the latitude and longitude for each fish seen. This is usually easily identified by multiple points at the same coordinates when the GPS was held over the fish.

Maps Waypoints(1	0) Routes(1)	Tracks(22)	👪 Tra	ck Prop	erties						
Name 🛆	Points	Start Time									
08-JAN-11T1-2	26		, Ж	b C	XIONI						ОК
08-JAN-11T13-	30										
08-JAN-11T7-8	36		Name	ACTIV	E LOG 006			Color: Del	fault 💙		ancel
09-JAN-11T17	14					1 -1 -1 -1					
09-JAN-11T21	27		Inde	< Time		Elevation	Depth	Temperature	Leg Length	Leg Time	Leg : 🛆
09-JAN-11T30	27		1	8/01/2	2011 9:38:53 AM	-0 m			28 m	0:00:16	6 km/
ACTIVE LOG 001	1	29/09/2010 5:33:2	2	8/01/- 8/01/-	2011 9:39:09 AM	om Sm			∠m 18m	0:00:02	4 km/
ACTIVE LOG 002	1	7/01/2011 5:26:45	4	8/01/:	2011 9:39:27 AM	6 m			2 m	0:00:17	0.5 k
ACTIVE LOG 003	22	7/01/2011 5:27:04	5	8/01/2	2011 9:39:44 AM	7 m			3 m	0:00:15	0.6 ki
ACTIVE LOG 004	4	8/01/2011 9:33:05	6	8/01/:	2011 9:39:59 AM	4 m			5 m	0:00:18	1.0 ki
ACTIVE LOG 005	9	8/01/2011 9:34:25	7	8/01/2	2011 9:40:17 AM	4 m			7 m	0:00:17	1.4 ki
ACTIVE LOG 006	182	8/01/2011 9:38:53	8	8/01/2	2011 9:40:34 AM	6 m			3 m	0:00:18	0.6 ki
ACTIVE LOG 007	12	8/01/2011 10:23:0	9	8/01/2 9/01/	2011 9:40:52 AM	6 m 7 m			/m 2m	0:00:17	2 Km/
ACTIVE LOG 008	149	8/01/2011 11:53:2	11	8/01/:	2011 9:41:25 AM	7 m 9 m			0 m	0:00:10	0.0 N
ACTIVE LOG 000	170	9/01/2011 11:55:2	12	8/01/	2011 9:41:45 AM	10 m			Om	0:00:18	0.0 ki
ACTIVE LOG 009	12	0/01/2011 12:35:3	13	8/01/:	2011 9:42:03 AM	10 m			0 m	0:00:12	0.0 ki
ACTIVE LOG 010	172	8/01/2011 2:39:14	14	8/01/:	2011 9:42:15 AM	10 m			1 m	0:00:11	0.3 ki
ACTIVE LOG 011	ь	8/01/2011 3:33:26	15	8/01/2	2011 9:42:26 AM	10 m			Om	0:00:15	0.1 ki
ACTIVE LOG 012	114	9/01/2011 9:13:06	16	8/01/2	2011 9:42:41 AM	9 m 9			0 m	0:00:13	0.1 ki
ACTIVE LOG 013	3	9/01/2011 9:58:03	1/	8/01/	2011 9:42:54 AM 2011 9:43:09 AM	9 m			1 m 1 m	0:00:15	0.1 K
ACTIVE LOG 014	145	9/01/2011 10:53:2	19	8/01/:	2011 9:43:25 AM	9 m			2 m	0:00:16	0.3 N
ACTIVE LOG 015	169	9/01/2011 12:48:3	20	8/01/2	2011 9:43:41 AM	11 m			1 m	0:00:15	0.3 ki
ACTIVE LOG 016	3	18/01/2011 3:01:3	21	8/01/:	2011 9:43:56 AM	11 m			0 m	0:00:14	0.1 k
			22	8/01 <i>ľ</i> :	2011 9:44:10 AM	11 m			2 m	0:00:15	0.4 ki
			5								2
			Cer	ter map o	on selected item(s)					Ter	
											vert
			P	bints	Length	Area	El	apsed Time	Avg. Speed	Filt	er
				.82	555 m	594 sq m		0:43:48	0.8 km/h		
			Links							Show F	Profile
			File/U	RL:				• (e) [Browse	Show	On Map

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APPENDICES

																1	1 Spotted handfish	
																2	2 Asterias amurensis	
																3	Stalked Ascidians	
ID	Diver	Date	Site	Transect	code	Species	coun	Fish ID n	size (mm)	depth	time	GPS	lat/lon	Latitude	Longitude		Comments	
1	Mark Green	8/01/2011	Sandy Bay	1	2	Asterias amurensis	17											
2	2 Mark Green	8/01/2011	Sandy Bay	1	3	Stalked Ascidians	4											
3	Emma Flukes	8/01/2011	Sandy Bay	1	2	Asterias amurensis	1											
4	Emma Flukes	8/01/2011	Sandy Bay	1	3	Stalked Ascidians	25											
5	Mark Green	8/01/2011	Sandy Bay	2	2	Asterias amurensis	54											
6	Mark Green	8/01/2011	Sandy Bay	2	3	Stalked Ascidians	38											
7	' Emma Flukes	8/01/2011	Sandy Bay	2	2	Asterias amurensis	43											
8	8 Emma Flukes	8/01/2011	Sandy Bay	2	3	Stalked Ascidians	53											
6	Mark Green	8/01/2011	Sandy Bay	7	2	Asterias amurensis	2											
10	Mark Green	8/01/2011	Sandy Bay	7	3	Stalked Ascidians	5											
11	Emma Flukes	8/01/2011	Sandy Bay	7	2	Asterias amurensis	2											
12	2 Emma Flukes	8/01/2011	Sandy Bay	7	3	Stalked Ascidians	9											
13	8 Mark Green	8/01/2011	Sandy Bay	8	2	Asterias amurensis	1											
14	Mark Green	8/01/2011	Sandy Bay	8	3	Stalked Ascidians	8											
15	Emma Flukes	8/01/2011	Sandy Bay	8	2	Asterias amurensis	0											
16	Emma Flukes	8/01/2011	Sandy Bay	8	3	Stalked Ascidians	11											
17	Mark Green	8/01/2011	Sandy Bay	13	2	Asterias amurensis	3											
18	8 Mark Green	8/01/2011	Sandy Bay	13	3	Stalked Ascidians	5											
19	Emma Flukes	8/01/2011	Sandy Bay	13	2	Asterias amurensis	0											
20	Emma Flukes	8/01/2011	Sandy Bay	13	3	Stalked Ascidians	6											
21	Mark Green	8/01/2011	Sandy Bay	14	2	Asterias amurensis	0											
22	2 Mark Green	8/01/2011	Sandy Bay	14	3	Stalked Ascidians	1											
23	8 Mark Green	8/01/2011	Sandy Bay	14	1	Spotted handfish	1		55	10.9	15:1	3 1	S42 54.430 E147 21.246	-42.907167	147.3541			
24	Emma Flukes	8/01/2011	Sandy Bay	14	2	Asterias amurensis	0											
25	Emma Flukes	8/01/2011	Sandy Bay	14	3	Stalked Ascidians	5											
26	Paul Day	8/01/2011	Sandy Bay	3	3	Stalked Ascidians	6											
27	Paul Day	8/01/2011	Sandy Bay	3	2	Asterias amurensis	2											

Appendix 1. Example of Data entry template in Excel

Appendix 2. Naming conventions for image files

Label all images of handfish using the following convention:

Site ID, Date, Transect ID, GPS ID, underscore, time of photo - all put together with no spaces. So the label for a fish recorded at Sandy Bay on 14 April 2012, Transect 04, using GPS4 and at 0938 hrs would be:

SB140412T04GPS4_0938.

Site IDs are: SB = Sandy Bay BP = Battery Point BB = Bellerive Bay HO = Howrah TR = Tranmere RB = Ralphs Bay MB = Mary Anne Bay OB = Opossum Bay HB = Halfmoon Bay