

Two signed hard copies of this Final Report Form should be returned to: Sue Utting, P O Box 68, Colwyn Bay, LL28 5WR  
An electronic version of this Final Report Form should be emailed to: s\_utting@seafish.co.uk

## Technology and Innovation Primers Project Final Report Form

### Section 1: Project details

|    |                                                          |                                                                                        |                      |                                           |
|----|----------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------|-------------------------------------------|
| 1. | (a) Seafish Project Code                                 | <input type="text" value="10605"/>                                                     |                      |                                           |
|    | (b) Project Title                                        | <input type="text" value="Domestication of hake broodstock and early rearing trials"/> |                      |                                           |
|    | (c) Project start date                                   | <input type="text" value="18 Sept 2006"/>                                              | (d) Project end date | <input type="text" value="17 Sept 2007"/> |
|    | (e) Seafish Project Manager                              | <input type="text"/>                                                                   |                      |                                           |
|    | (f) Name and address of contractor                       | <input type="text" value="Viking Fish Farms Ardtoe Marine Laboratory"/>                |                      |                                           |
|    | (g) Name of contractor's Project Leader (if appropriate) | <input type="text" value="Dr James Treasurer"/>                                        |                      |                                           |

### Section 2: Project Summary

2. Please provide a brief (no more than 1 side of A4) summary of the project and its results

The objectives of the current project were to establish a hake broodstock and to source eggs and larvae and these would be used for scientific studies of larval development and biology.

Programme of work:

## 1. Acquisition and domestication of hake broodstock, broodstock handling and nutrition.

Outcome: The project has involved extensive and prolonged attempts by Ardtoe to catch broodstock hake by trawl and also juveniles, but many fish that have been captured came to the surface with the stomach inverted. Although some fish survived capture and were alive on transfer to the hatchery the trauma has induced mortality within 24 hours. Consequently other methods of capture were used such as line capture and traps.

Angling:

Initial capture was attempted in Loch Etive and, although several whiting were caught, there were no hake. Most of the angling has been from a local charter boat in North Ardnamurchan, in an area termed the "hake tow", also 7 km west of Loch Cean Traigh, 1 km offshore, off Arisaig, near Glenuig and opposite the island Eilean Shona. Angling involved the use of lures and bait but only whiting were caught.

Fish capture with traps:

Given the difficulties in angling for hake capture efforts transferred to the use of fish traps. This has entailed working with local fishermen using modified fish and crab traps. Currently work is ongoing in the Loch Nevis and Sunart areas using modified traps with special soft inward pointing entrances to retain fish and these are also baited.

Work has also involved joint trials with FRS Marine Laboratory, Aberdeen using large fish traps in the Sound of Arisaig. FRS agreed to lend traps for longer term deployment and these have continued to be used in the Ardnamurchan and Loch Nevis areas.

Example location: Sound of Arisaig, 3 km south of Arisaig, 2 km north of Glenuig, and Loch Cean Traigh.

Two traps (2 m x 1.5m x 1m) were baited with mackerel, fish oil, squid and marine sausage and deployed in water of 15 metres depth, and another 2 traps were fished in deeper water of 30 metres. The traps were lifted and the total catch comprised: Whiting 40, Poor cod 39, Goldsinny wrasse 2, Cod 5

Egg collection attempts at various locations:

Example: as a visiting researcher on the FRS Scotia May 2007: Length and weight measurements were carried out on adult hake, the gonad and liver weighed, and otolith samples taken from a sample of fish.

Results: Fishing at the Flannan Isles, one tow at 540 metres and the second at 760 metres, and the third at 1000 metres depth. Four hake were captured, two mature females of 3380 g and 3190 g, one immature female and one male. From examination of the ovaries it appeared that the fish were several weeks from spawning, ca 6 weeks. The fish were measured, gonad samples taken and otoliths removed.

Fishing SE Rockall at 680 metres. No hake captured, but ca. 200 species of other fish, including grenadiers (Macrouridae).

Fishing at 650 metres in the Anton Dohrn Seamount. Mixed species and mesopelagic tows. No hake

Continuing trawl samples and plankton tows on the Anton Dohrn Seamount. A wide variety of fishes was captured.

Continental shelf east of Suilisker. 14 hake captured, one male with milt running but none of 13 females was spawning. 11 of the fish were at an early stage of oocyte development, and the other 2 fish were in mature, but not in spawning condition. The fish were measured, ovaries sampled, and otoliths removed. These fish had a mean length of 565 mm, 102 g mean weight, a mean ovary weight of 16.5 g, a gonadosomatic index of 0.9%, liver weight of 55 g and hepatosomatic index (HSI) of 4.1%. Ovaries were in various maturity stages II=developing and III= maturing.

Blue ling eggs were also collected and subsequently transferred to Ardtoe for incubation and these were taken to hatch (see Fishing News August 2007).

Trawl catches: example: in Loch Nevis:

A total of four separate trawls was carried out, each trawl being of relatively short duration, approx 60-90 mins and a slow speed in order to minimise stress and physical damage to fish in the net. The best and fittest fish were selected and kept in an oxygenated tank on board. Despite the efforts to minimise stress and physical damage to the fish all species suffered from over-inflation of the swim bladder to varying degrees and/or physical damage from the trawl net. The gas was released from the swim bladder or body cavity with reasonable success but the additional stress of this procedure on top of the capture proved too much for many of the fish and they subsequently died later. At the end of the trip a total of 39 Hake was loaded into a transport tank and taken to Ardtoe by road and placed in a holding /quarantine tank that evening, but did not recover overnight. Data on lengths, weights and liver weights were recorded and samples for histology were taken. In the trawls in December 2006 it was evident that Loch Nevis is being used as a Nursery ground by hake, 39 fish were measured with a mean length of 229 mm, 87 g weight, liver weight=2.3 g and HSI of 2.4 %. This compares with HSIs in the same trawl of cod juveniles of 6%, 6.3% for haddock, 5.7% in pollack and 3% in whiting. In April 2007, from 29 fish measured the mean length was 260 mm, 110 g mean weight, 2.9 g liver wt and an HSI of 2.3%.

Trawls were also made in the Firth of Clyde in August but the water and air temperatures were high and none of the 17 fish recovered survived overnight.

North Sea Survey: In November trawl catches were examined in a 10 day cruise on a commercial fishing boat working 70 km north east of Aberdeen. Large hake of 2 to 4 kg were frequently captured but none of the 45 fish retained survived.

2. Objective: larval rearing practices including live feed regimes and environmental conditions investigated, and survival and growth at all stages of development measured: no material was available for this; juvenile and adult hake were captured, measured and biological statistics such as liver weights, gonad weights, egg dimensions, and ovarian development obtained.

### Has the project achieved what was originally proposed and if not, why not?

The project intended to acquire and domesticate a hake broodstock. Despite the use of various methods including angling, trawls, traps and egg collection, no hake have survived capture by more than 12 hours. Considerable data have been obtained on hake biological statistics and hake ovaries in different stages of maturity have also been collected.

It would appear that the hake is a very delicate fish and there is great difficulty in capturing hake and in retaining alive. To date, no captive hake are present in Europe.

It is felt that collection of hake eggs from captured wild fish at sea would be the best route for establishing a hake broodstock, and this route will be continued over the coming year.

**It is Seafish's intention to publish the Project Summary.  
Do you agree to Seafish being the co-ordinator of such publication?**

YES

**If the answer is NO, please explain why the Final Report should not be released into the public domain.**

### Section 3: Project costs and staffing input – complete relevant boxes

4. In this project, what was the:

|                                             |        |
|---------------------------------------------|--------|
| (a) grant awarded?                          | £5000  |
| (b) actual expenditure?                     | £5000  |
| (c) approved staff input?                   | £5130  |
| (d) actual staff input?                     | £9,300 |
| (e) projected industry contribution in cash | £5000  |
| (f) actual industry contribution in cash    | £5000  |
| (g) projected industry contribution in-kind | 0      |
| (h) actual industry contribution in-kind    | 0      |

### Section 4: Publications and other outputs

4. (a) Please give details of any outputs, e.g. published papers, articles, presentations, physical outputs

Development of the use of fish trap techniques for fish capture.

Unpublished reports, including photographs, of fish capture by trap and egg collection on boat.

Basic statistics and reproductive biology of hake will be reported.

(b) Have opportunities for exploiting Intellectual Property arising out of this work been identified? If you have answered YES, please give details.

NO

(c) Has any action been taken to initiate Technology Transfer? If you have answered YES, please give details.

NO

## Section 5: Future work

5. Please comment briefly on any new opportunities which may arise from the project.

The work on sourcing broodstock hake continues both in trap captures and in sourcing hake eggs. This will be followed by rearing trials. The work on capturing inshore fishes using latest trap designs may give a useful tool for assessing stocks.

## Section 6: Declaration

6. I declare that the information I have given is correct to the best of my knowledge and belief. I understand that the information contained in this form may be held on a computer system.

Signature

Name

James Treasurer

Date

15 September 2007

Position in Organisation

Research Manager

Scotia 2007 cruise

9-16 May 2007

Flannan Isles, Rockall Trough, Anton Dohrn Mount, Rosemary bank, Suilisker

Hake measurements

| Date      | Fish no. | Coord     | Length<br>mm | Wt g     | Male/Femæ | Gonad wt | GSI      | Liver wt |
|-----------|----------|-----------|--------------|----------|-----------|----------|----------|----------|
| 10-May-07 | 1        | Flannan   | 840          | 3380     | F4        | 54.2     | 1.60355  | 170      |
|           | 2        |           | 820          | 3190     | F4        | 68.4     | 2.144201 | 64       |
|           | 3        |           | 470          | 734      | F2        | 5        | 0.681199 | 26       |
|           | 4        |           |              |          | M4        | 1.6      |          | 8.6      |
|           | mean     |           | 710          | 2434.667 |           | 32.3     | 1.476317 | 67.15    |
| 15-May-07 | 1        | Suilisker | 650          | 1708     | F4        | 38       | 2.224824 | 52       |
|           | 2        |           | 672          | 1886     | F3        | 14       | 0.742312 | 98       |
|           | 3        |           | 635          | 1968     | F3        | 16       | 0.813008 | 92       |
|           | 4        |           | 608          | 1770     | F4        | 26       | 1.468927 | 86       |
|           | 5        |           | 545          | 1114     | F3        | 6        | 0.5386   | 48       |
|           | 6        |           | 502          | 830      | F3        | 4        | 0.481928 | 20       |
|           | 7        |           | 515          | 976      | F3        | 6        | 0.614754 | 40       |
|           | 8        |           | 480          | 718      | F3        | 4        | 0.557103 | 34       |
|           | 9        |           | 484          | 748      | F3        | 4        | 0.534759 | 28       |
|           | 10       |           |              |          | M5        | 47       |          |          |
| mean      |          |           | 565.6667     | 1302     |           | 16.5     | 0.886246 | 55.33333 |

| HIS      | Gut wt   |
|----------|----------|
| 5.029586 | 128      |
| 2.00627  | 30       |
| 3.542234 | 50       |
|          | 4.4      |
| 3.52603  | 53.1     |
| 3.044496 | 158      |
| 5.196182 | 1708     |
| 4.674797 | 1698     |
| 4.858757 | 1620     |
| 4.308797 | 1020     |
| 2.409639 | 766      |
| 4.098361 | 912      |
| 4.735376 | 680      |
| 3.743316 | 704      |
| 4.118858 | 1029.556 |



