

Summary of the data collected during the 2005/06 Monkfish Observer Programme

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Fisheries Development Note

No. 21

August 2006

Introduction

As part of an effort towards obtaining better scientific data in relation to monkfish (aka anglerfish) catches and providing independent verification of catch rates Fisheries Research Services (FRS), Aberdeen contracted the NAFC Marine Centre to undertake an Observer Programme from August 2005 until end-March 2006. This Programme was to comprise, up to a maximum of 20 observer trips on vessels fishing out of Shetland or Kinlochbervie. During these trips catch rate and biological data on both white-bellied monkfish *Lophius piscatorius* and black-bellied monkfish *L. budegassa* were to be recorded. In addition to the observer trips the NAFC Marine Centre is co-ordinating the collection and collation of data from Shetland vessels participating in the Monkfish Tally Book Scheme.

Methods

During observer trips skippers were requested to fish as normal. For each haul, shooting and hauling positions and times, water depth, towing speed and weather conditions were recorded. Additional relevant information was also recorded e.g. fouled gear.

Sampling Protocol

Depending on the individual vessel set-up, the observer recorded either the total live weight (LW) or gutted weight (GW) of monkfish caught during each haul. If more monkfish were caught than could be sampled during the time that it took the crew to process the rest of the catch then representative sub-samples were taken. For each trip two monkfish per 1 cm length increment plus as many as possible >70cm in length were sampled where full biological data were collected (this included live, gutted and gonad weights, sex and maturity stage data and the collection of otoliths). The length, sex and maturity or length only of remaining sampled monkfish was recorded. The composition of the catch from each haul was recorded.

Results

During the 15 observer trips that were completed a total of 146 hauls were made over a period of 1461 hours of fishing time and 21352 monkfish were sampled. An estimated 27229 monkfish were caught.

Vessel Coverage

During August, December and March three observer trips were completed at the West of Scotland. During August, when the observer was available there were no vessels targeting monkfish from Kinlochbervie. The observer eventually got a trip on a vessel working from Ullapool. However this vessel was primarily targeting *Nephrops* but had a monkfish bycatch. The December and March trips were from Kinlochbervie and on vessels targeting monkfish.

At Shetland the 12 trips undertaken covered nine of the approximately ten vessels that regularly target monkfish. Over the duration of the Programme there were times when almost all of the relevant vessels were targeting large aggregations of haddock and other whitefish. As a result, on four of the trips at Shetland the main target was whitefish. In these instances, after considering vessel and observer availability, trips were undertaken with the objective of getting as much area coverage as possible.

Area Coverage

The area of coverage is shown in Figure 1. The areas covered around Shetland are considered representative

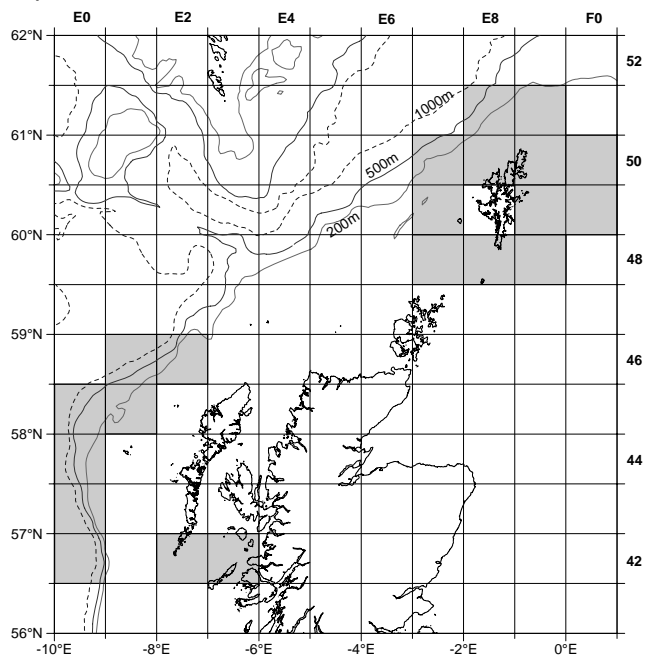


Figure 1 Shaded areas indicate statistical rectangles sampled during the Programme.

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of the areas where most fishing activity occurred during the sampling period. The areas sampled between 57°N and 59°N are considered representative of areas where a high proportion of the west of Scotland targeted monkfish fishery occurs. The samples in statistical rectangles 42E2 and 42E3 occurred during the August trip when monkfish was only a bycatch.

Catch Rates

Catch rates varied both within and between trips. Over the Programme catch rates ranged from 0 – 77 monkfish per hour (average 18.6). This was equivalent to 0 – 116 kg(GW) per hour (average 33 kg(GW) per hour).

The data can be grouped in a number of different ways and different comparisons made. The catch rates are shown as average kg(GW) per hour by statistical rectangle in Figure 2. This indicates that catch rates are higher towards the shelf edge.

The data can also be grouped according to fishing location, target species and depth and this is shown in Table 1. This shows the highest catch rate occurred in the West coast targeted monkfish fishery in waters <320m. It should be noted that these calculations do not take into account factors such as vessel size and power, or gear differences (single or twin trawl). The monkfish vessels sampled from Kinlochbervie were larger and had higher power than any of the vessels sampled at Shetland.

At the West coast, catch rates expressed as monkfish per hour, were significantly higher in depths <320m compared to catches from depths >600m ($t = -5.477$, $df = 43$, $P < 0.0001$) but when catch rates are expressed as GW/hr there was no significant difference between catch rates ($t = -1.905$, $df = 43$, $P > 0.05$). This is due to catches from depths <320m comprising of high numbers of smaller monkfish compared to catches from >600m where the catch is of lower numbers of larger fish. This resulted in overall weights per hour that were not significantly different.

Prevalence of black-bellied monkfish

Around Shetland *L. budegassa* accounted for 0 – 5% of the monkfish catch per trip (by number). There was a general pattern of higher frequencies of *L. budegassa* to the NW compared to the SE of Shetland. At the west of Scotland in the trip targeting *Nephrops* there were 20% *L. budegassa*. The other two trips to the west of Scotland yielded 15% *L. budegassa* from hauls in depths <320m but in depths >600m *L. budegassa* were rare, 0.7% of the monkfish catch.

Discards

There is no legal minimum landing size for monkfish. Discards consist of monkfish less than around 30cm in length, although some vessels retain monkfish much smaller than this. Discards may also be of “scrubbed” monkfish i.e. those that have been stuck in the net from the previous haul. Overall the discard rate was low at 2.6% by number and 0.3% by weight of the monkfish catch.

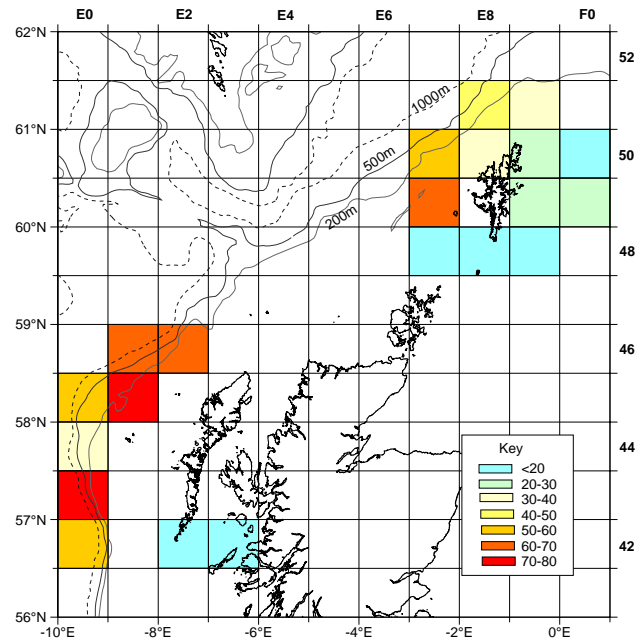


Figure 2 Catch rates shown as average kg(GW) per hour for statistical rectangles sampled during the Programme.

Around Shetland the discard rate was 3.7% by number and 0.5% by weight. 43% of the hauls where monkfish were targeted had zero discards. 13% of the hauls where whitefish were targeted had zero discards but these hauls tended to be in areas where monkfish were smaller.

In the West of Scotland monkfish fishery 0.8% by number and 0.1% by weight of monkfish catches were discarded and on 60% of hauls zero discards were recorded. The trip where *Nephrops* was the main target was on a vessel that retained all small monkfish.

Length Frequency

Within trips it was often found that length frequency distributions of *L. piscatorius* could vary significantly between for example, different statistical rectangles or between different depths. The percent length frequency distributions of *L. piscatorius* and *L. budegassa* sampled during the Programme are shown in Figure 3.

Paired comparisons were made between each of Shetland, West coast (<320m and *Nephrops* combined) and West coast (>600m) using Kolmogorov-Smirnov 2-sample tests. Results indicated significant differences between length frequency distributions from each of the paired samples (all at $P < 0.01$). Mean lengths from these groups were 50, 49 and 60cm respectively. Although the Shetland and West coast (<320m and *Nephrops* trip combined) groups have similar mean lengths it is seen from Figure 4 that the length frequency distributions are different in shape, as has been proven by the statistical test.

A Kolmogorov-Smirnov 2-sample test was used to compare length frequency distributions of *L. budegassa* from Shetland and from the West coast and indicated that a significant difference existed between the distributions. The length frequency distributions are shown in Figure 5.

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Table 1 Average catch rate (number and gutted weight per hour) ± standard deviations for different categories of hauls.

Group	Number of hauls	Number / hour		GW (kg) / hour	
		Average	±SD	Average	±SD
Shetland (all)	190	15	9.3	26.6	18.4
Shetland (Target: monkfish)	123	18	9.5	33.7	18.1
Shetland (Target: whitefish)	67	9	5.3	12.0	6.5
West Coast of Scotland (all)	56	32	20.7	56.4	33.6
West Coast (Target: monkfish)	45	38	38.0	68.1	25.4
West Coast (Target: <i>Nephrops</i>)	11	6	1.2	6.7	2.0
West Coast (Target: monkfish, depth <320m)	32	45	15.3	72.7	24.4
West Coast (Target: monkfish, depth >600m)	12	20	9.3	57.1	25.3

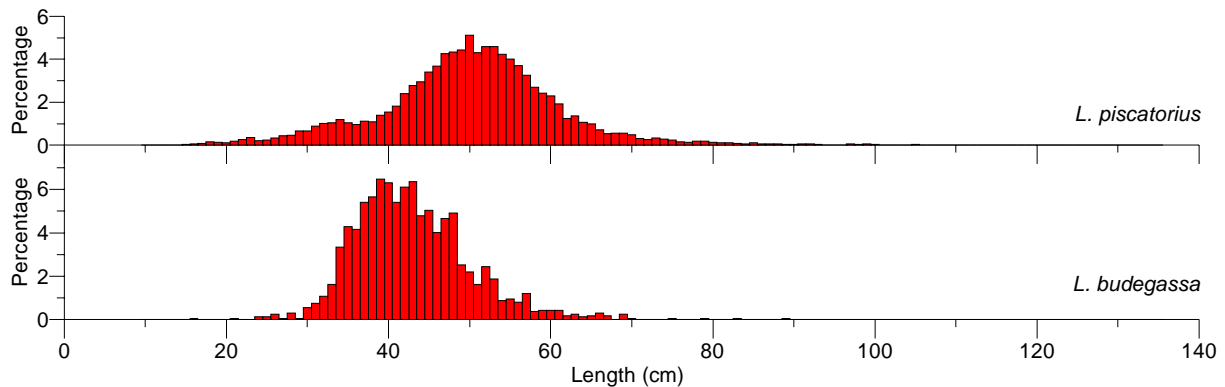


Figure 3 Percent length frequency distributions of white-bellied (*L. piscatorius*) (n = 19762) and black-bellied (*L. budegassa*) (n = 1590) monkfish sampled during the Programme.

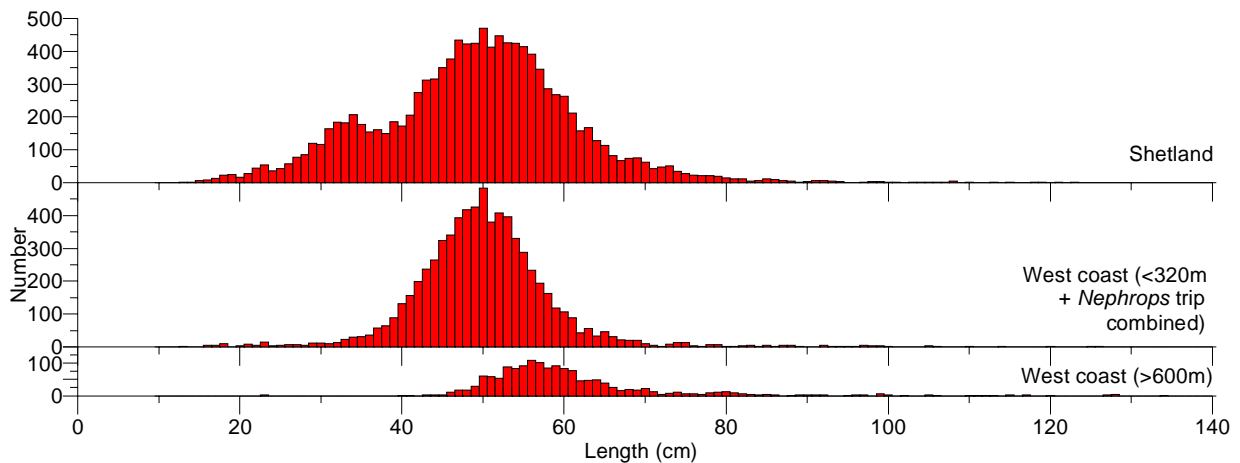


Figure 4 Length frequency distributions of *L. piscatorius* sampled at Shetland (n = 11340), at the west coast (depths <320 and *Nephrops* trip combined) (n = 6923) and west coast (depth >600m) (n = 1499).

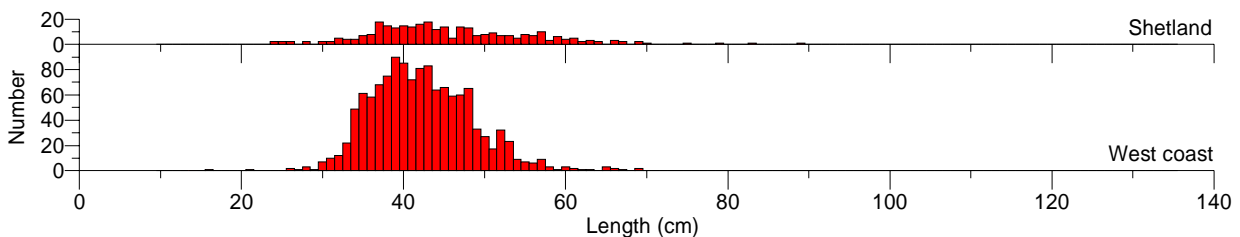


Figure 5 Length frequency distribution of *L. budegassa* sampled at Shetland (n = 312) and at the west coast of Scotland (n = 1278) during the Programme.

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Maturation and Reproduction (*L. piscatorius*)

Males with ripe testes were recorded from September onwards, but with highest frequencies during December and January. Spent males started appearing from January. Ripe females were recorded from December onwards.

The amount of investment that a fish makes in reproduction can be quantified using a Gonosomatic Index (GSI). This is the gonad weight expressed as a percentage of the gutted weight of the fish. The ripe gonads of males and females were on average 2.3% and 18.5% of their gutted body weight respectively.

The length at which 50% of fish had reached maturity ($L_{50\%}$) was calculated to be 102 cm for females and 57 cm for males. Proportions reaching maturity at given lengths are shown in Figure 6.

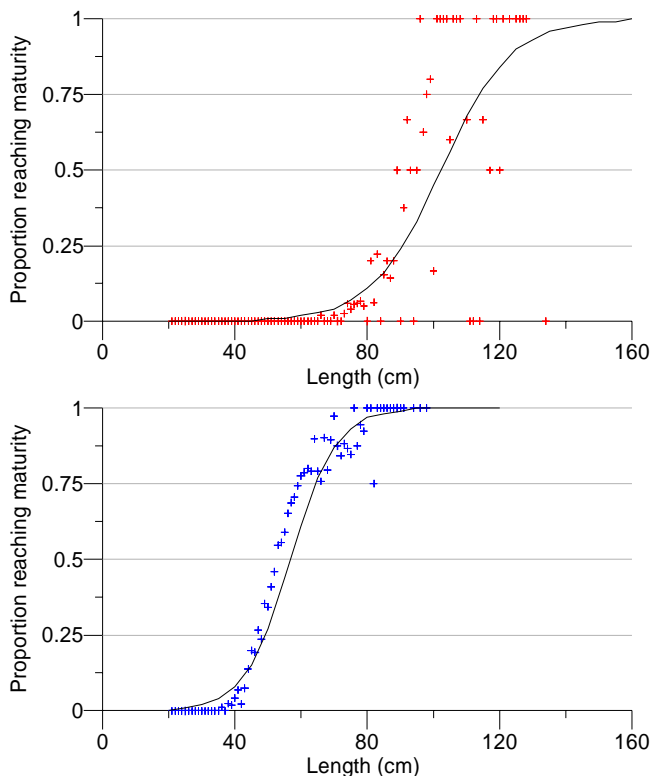


Figure 6 Proportion of female (top) and male (bottom) *L. piscatorius* reaching maturity at different body lengths.

Sex Ratio

The sex ratio (expressed as proportion female) of *L. piscatorius* sampled during the Programme is shown in Figure 7. The proportion of females increases steadily at lengths greater than 60cm and at lengths above 100cm almost all monkfish are female.

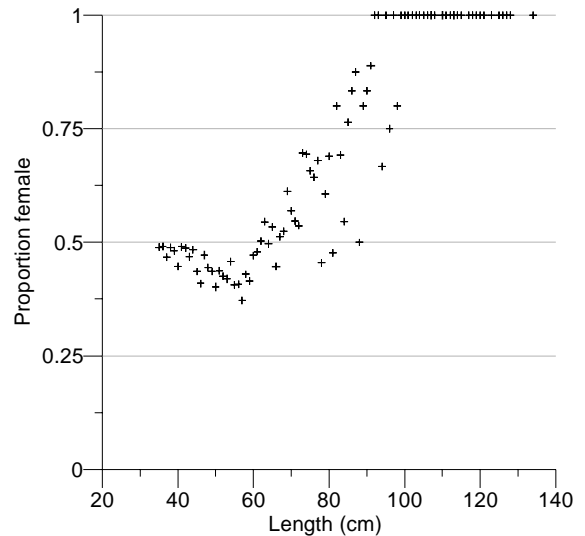


Figure 7 Sex ratio of *L. piscatorius* sampled during the Programme.

Summary

The data that has shown its immediate importance has been the data relating to catch rates. The catch rate data collected during observer trips has provided independent verification of the catch rate data being accumulated as the Tally Book Scheme progresses. The biological data will show its importance in relation to stock assessments.

The data collected during this Programme together with additional data collected by FRS was presented by FRS to the Scientific, Technical and Economic Committee for Fisheries (STECF) who were tasked with reviewing scientific evidence prior to a mid-term review of the 2006 monkfish TAC. In light of the scientific evidence presented the STECF recommended a 10% increase in the 2006 monkfish TAC. To the frustration of scientists and fishermen alike the original decision to allow a 10% increase was overturned at a plenary session of the committee.

Collection and collation of data for the Tally Book Scheme is ongoing, and by its nature the value of the data-set being built up under the Scheme will increase as time goes on.

Acknowledgments

The Programme was funded by FRS Marine Laboratory, Aberdeen. Thanks goes to skippers and crews on vessels who were asked to participate by accommodating observers.