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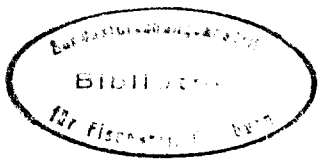

SQUID IN THE ENGLISH CHANNEL

by

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Summary

Several species of squid occur in the Channel, but of these only Loligo forbesi is of commercial importance. This species spawns in the western Channel in winter, the young squid first appearing in the bottom trawl at 8-10 cm mantle length in late May. Subsequent growth is rapid, the squid spawning and dying in the winter of the same year. During the summer L. forbesi tends to move into the warmer waters of the eastern Channel and southern North Sea, but in autumn returns to the western Channel. Loligo may be taken in bottom trawls by day, but appear to leave the bottom at night. Attempts to catch them in a pelagic trawl have so far proved unsuccessful. Loligo has been used for bait but is increasingly marketed for human consumption. Figures are given for landing at ports in S.W. England over the past five years.

Introduction

Squid are important members of marine food chains, feeding upon fish and crustacea, and in their turn being preyed upon by fish, birds and mammals. In the English Channel three loliginid squids - Loligo forbesi, L. vulgaris and Alloteuthis subulata are regularly present, while the more oceanic ommastrephid squids - Illex coindeti and Todaropsis eblanae - occur sporadically, mainly at the western end of the Channel.

The squid most commonly taken off Plymouth is Loligo forbesi, although L. vulgaris may at times, particularly in the early spring, be the only species taken. The small squid Alloteuthis is common on occasions, but tends to pass through the meshes of commercial trawls. Loliginid squids are distinguished by the presence of a continuous membrane of skin over the eye, while ommastrephid squids have a slit in the skin around the eye so that the lens is in contact with the sea. Loligo forbesi is distinguished from L. vulgaris by the relative sizes of the suckers on the tentacular clubs, and in the presence of longitudinal colour streaks on the underside and flanks.

Life history of Loligo forbesi

Loligo forbesi is regularly taken in bottom trawls in the western

English Channel during summer and autumn, becoming scarce in the late winter and spring. A recent paper (Holme, 1974) describes its life history in the area, so that this is treated in outline only, emphasis being on the gaps in our knowledge of this species.

Because of their ability for fast movement, squid are elusive, and young stages of Loligo are very rarely taken in plankton nets or in fine-meshed pelagic trawls. They are first taken in bottom trawls when the dorsal mantle length has attained 8-10 cm., and from this size upward are a regular constituent of trawl catches. On the Plymouth Laboratory's ships modifications of the otter trawl have been made through the years to improve the effectiveness of the trawl not only in catching squid but in preserving them in better condition, alive if possible, for physiological research on the giant axon. It has been found that raising the height of the headline improves catching power, and if the footrope is lightly weighted so that it does not dig into the bottom the reduction in benthic material taken minimises damage in the cod end. Squid seem to live close to the bottom by day, but at night they apparently leave the bottom, since they are not taken in bottom trawls after dark. Experiments with a pelagic trawl failed to catch squid, either by night or day, in mid-water or when fished with the footrope only a metre or two above bottom. It would be interesting to know if squid are captured in significant numbers in the larger pelagic trawls worked by commercial boats. In Scottish waters squid are caught in seine-nets as well as in trawls (Thomas, 1969).

At times, particularly in July and August, squid may suddenly disappear from the trawl catches. Although this may mean they have left the area it is possible that they are swimming off the bottom by day as well as by night, perhaps feeding on pelagic fish in the warm surface waters, and are therefore inaccessible to bottom trawls. However there is no firm evidence on this point.

Squid are voracious feeders, but owing to the rapid rate of digestion, identification of gut contents is difficult. They seem to normally feed on fish, particularly gadoids, but crustaceans are also taken, and occasionally cephalopod remains are found. Feeding certainly takes place during daylight hours but there is insufficient evidence as to whether this continues after dark.

The growth and life cycle of Loligo forbesi is summarised in Figures 1 and 2. Because of the similarity in results in different years those from 1962-69 have been combined in a single figure. Off Plymouth the

young squid first appear in the trawl in late May when the mantle length is about 10 cm. Subsequent growth is rapid, about 25 mm per month, so that by the end of the year the females have attained a length of about 27 cm. At all stages the males show a much greater spread in length measurement than the females, populations being typically polymodal, but by analogy with the females it is thought that they reach adult size, about 30 cm, within the year. Gonads of both sexes ripen through the autumn, and females appear to spawn from December onwards. The absence of spent individuals at this time indicates that neither sex survives beyond a single spawning season. Further evidence that there is no preferential mortality of one sex after spawning is provided by the sex ratios (Table 1). In summer the sex ratio in the catches is about 1:1, but through the autumn the percentage of females rises to about 70% of the total. Whether this is a reflection of population composition or whether it results from differential catching of the two sexes is not known. During the spawning season the percentage of females remains constant whereas if only one sex were to die after spawning this would be revealed by a changing sex ratio.

The spawning period is indicated by the presence of ripe females in the samples, and by occasional egg masses in the trawl. There is no evidence of localised mass spawnings as have been observed in Loligo opalescens off California. It is possible that spawning occurs at different times in various parts of the western channel, but it seems to be completed in all areas by April, by which time adult squid have virtually disappeared.

The spawn consists of clumps of finger-like jelly masses which are attached to the bottom. Overhanging rocks are possibly favoured for spawning so that the spawn hangs clear of the bottom, but such places would be mainly inaccessible to thetrawl, so that spawn has in fact been recovered from such objects as a submerged tree branch, submerged fishing floats, rope moorings and from crab pots. Incubation is thought to take 4-6 weeks in winter, so that the first squids should have hatched by the beginning of February. No observations have been made on the rate of development of L. forbesi, but data on other loliginid squids (Summers 1968; LaRoe, 1971) indicate a growth rate of 20 mm/month for the first few months after hatching. If young L. forbesi taken in late May had been hatched in February of the same year this would require a growth rate of 25 mm/month. Since L. forbesi grows to a rather larger size than some of the other species investigated it seems likely that those sampled in May were hatched the previous winter so that the squid grows to maturity,

spawns and dies within a single year.

Apart from the main population of winter spawning L. forbesi there is also a small summer spawning population, not represented in the samples every year. The females spawn at a length of about 20 cm, as opposed to about 29 cm for winter spawners. This population is thought to be also annual, and to be quite discrete from the winter spawners.

The results outlined above are based mainly on material collected off Plymouth, but it is known that squid migrate so that they are likely to be based on more than one population. Seasonal movements have been followed by a number of synoptic trawl surveys (e.g. Fig. 3). Sampling must necessarily be restricted to known trawling grounds, some of which are widely separated, so that the data are far from complete. However it appears that the general pattern of movement is as follows. In winter L. forbesi is absent from the southern North Sea (Kristensen, 1959) and populations occur mainly in the western Channel, although some specimens have been taken offshore in the eastern Channel. Distribution may depend upon the severity of the winter, since L. forbesi does not seem to occur when the sea temperature is below 8.5°C. In the very severe winter of 1963 this species was probably restricted to the western end of the Channel, where landings were made at Newlyn even in February, whereas the distribution shown in Fig. 3 may be typical of a mild winter. It will be noted that there is a tendency for the squid to occur offshore in the winter, where temperatures are higher than in coastal regions.

The young squid, first appearing off Plymouth in May, range throughout the Channel and southern North Sea in the summer, but with the onset of autumn they move westward, becoming common again off Plymouth from late September onwards. In this way the squid take advantage of high temperatures in the eastern Channel and southern North Sea in summer but avoid the low winter temperatures which occur in these same areas in winter. Spawning takes place when sea temperatures are approaching their minimum, but the spawn may be rather more tolerant of cold than are the adults since apparently healthy spawn was taken off Plymouth on 19 and 21 March 1963 following a period when sea temperatures had dropped to 5° or less.

Economic importance

Loligo forbesi is the only squid of any economic significance in the Channel, although squid catches may at times contain some L. vulgaris. Squid are caught in the course of bottom trawling for fish, where they

make a significant addition to mixed catches. Catches are not sufficient for boats to fish specifically for squid. Squid have long been popular with anglers for bait and have been used as bait for longlines, but have in recent years been increasingly marketed for food. Much of the catch from S.W. England ports is eventually sold to restaurants specialising in Mediterranean food in London and elsewhere in the United Kingdom.

Figures for weight and value of landings at ports in S.W. England are shown in Table 2. At Newlyn and Brixham squid formerly contributed about 1% of the total value of fish landed at these ports, but the percentage has declined in the last year or two. Table 3 gives some indication of quantities of squid caught per 2 hr trawl by the Laboratory's research vessels. The greatest catches are invariably in autumn and at this time the nearly-mature squid are of much larger size than those caught in summer.

References

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Table 1

Loligo forbesi. Percentage of females from trawl catches off Plymouth, June 1962-January 1969.

Month	No. in sample	%♀♀
Jan.	389	68.4
Feb.	138	68.8
Mar.	35	74.3
Apr.	17	58.8
May	289	43.3
June	969	50.4
July	672	49.7
Aug.	725	56.0
Sept.	474	64.1
Oct.	771	65.4
Nov.	993	70.9
Dec.	541	69.3

Table 2

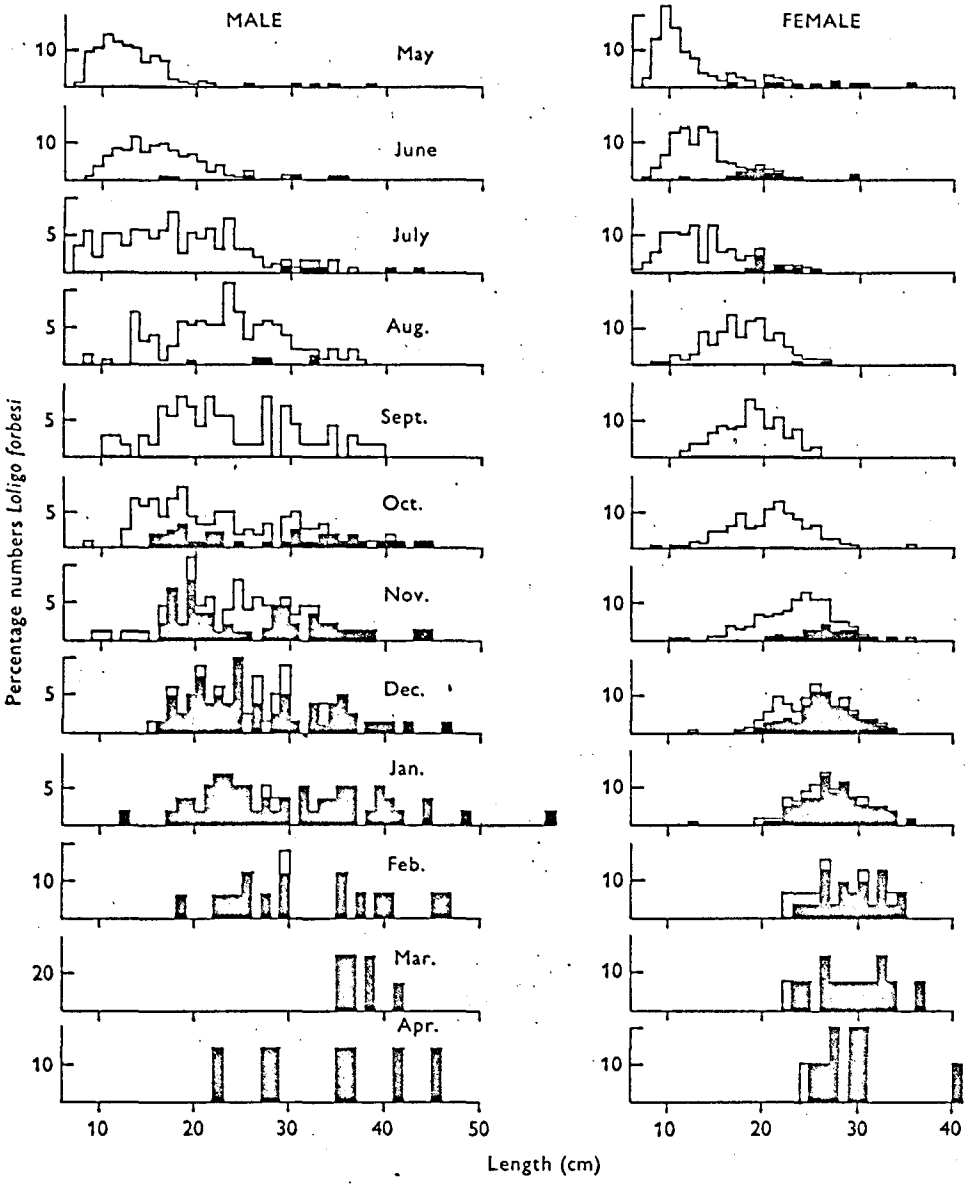
MAFF returns for landings of squid in S.W. England (mainly Devon and Cornwall). At some ports squid are landed in such small quantities that they may be omitted from the returns. However returns from the larger ports of Brixham and Newlyn may be fairly complete.

	Squid			All fish and shellfish (£)	Squid as percentage value of all fish
	Weight (cwt)	(tonnes)	Value (£)		
1969					
Total S.W. district	1591	80.8	9034	1,397,369	0.65
Brixham	484	24.6	2625	247,799	1.06
Newlyn	1071	54.4	6226	342,549	1.82
1970					
Total S.W. district	1045	53.1	7837	1,486,654	0.53
Brixham	413	21.0	3102	270,018	1.15
Newlyn	605	30.7	4580	395,914	1.16
1971					
Total S.W. district	1285	65.3	9063	1,747,882	0.52
Brixham	488	24.8	3227	305,985	1.05
Newlyn	748	38.0	5485	494,093	1.11
1972					
Total S.W. district	876	44.5	7954	2,092,421	0.38
Brixham	406	20.6	3813	457,283	0.83
Newlyn	408	20.7	3650	553,736	0.66
1973					
Total S.W. district	908	46.1	11561	3,277,404	0.35
Brixham	522	26.5	5434	833,109	0.65
Newlyn	335	17.0	5448	804,690	0.68

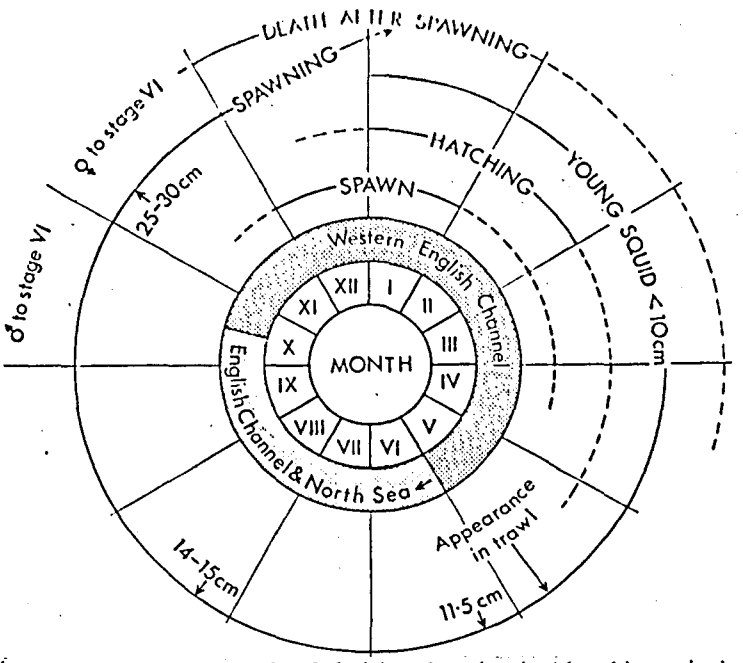
Table 3

Loligo forbesi. Catch per 2 hours' trawl on Looe grounds, near Plymouth

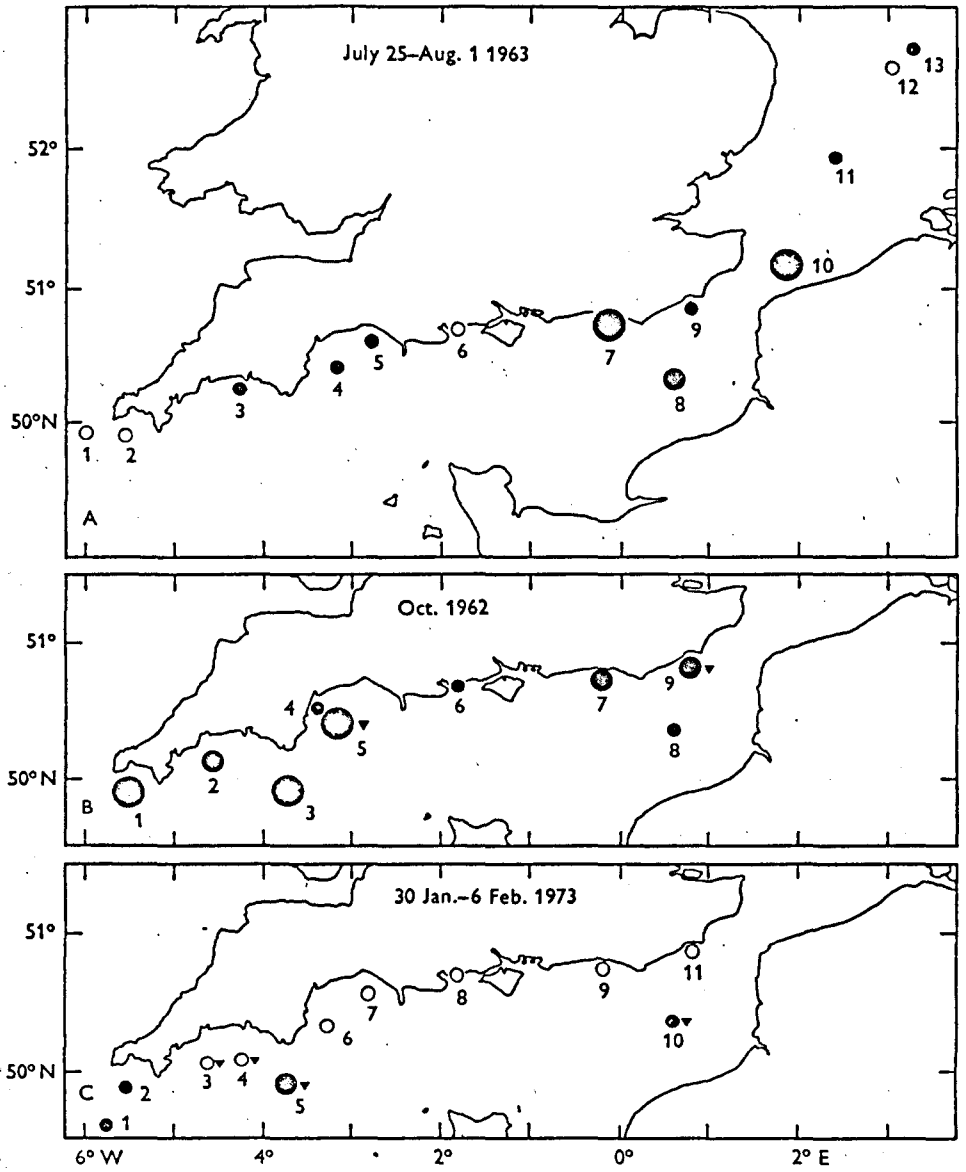
Month	No. of hauls	Wet weight/ 2h trawl (Kg)	Mean wt/ squid (g)
1966			
Jan.	2	8.4	478
Feb.	4	3.4	596
Mar.	3	2.9	583
Apr.	1	1.2	387
May	-	-	-
June	3	0.3	312
July	-	-	-
Aug.	4	4.8	306
Sept.	4	16.6	331
Oct.	3	14.8	315
Nov.	6	13.9	408
Dec.	2	10.8	538
1967			
Jan.	1	3.1	456
Feb.	4	3.5	657
Mar.	4	1.7	697
Apr.	2	1.5	728
May	-	-	-
June	2	6.6	62
July	2	3.7	65
Aug.	3	4.2	121
Sept.	2	6.0	205
Oct.	3	6.3	345
Nov.	5	20.5	429
Dec.	5	10.6	418
1968			
Jan.	4	7.1	523
Feb.	3	0.4	428
Mar.	4	0.2	620
Apr.	2	0.3	605
May	5	1.4	80
June	3	9.6	78
July	5	0.9	87
Aug.	1	0	-
Sept.	-	-	-
Oct.	5	9.1	436
Nov.	3	6.1	428
Dec.	5	6.2	547



Text-fig. 1 Annual growth cycle of *L. forbesi*, shown by combining all samples from 'Sula' from 1962 to 1969. Stage VI in solid black. Note the compact grouping of the histograms for the females, although several years' data have been combined.



Text-fig. 2. Tentative life-cycle of *Loligo forbesi*, based on the view that this species is an annual. Durations of the different phases are very approximate, the principal periods being shown by a continuous line, and the total range by the broken lines. From the centre, the successive circles show month of the year; occurrence in the Channel and southern North Sea; periods of spawn occurrence; hatching; growth of squid from small stages under 10 cm too small to be caught by the trawl, and lengths at successive time intervals subsequently. Stage VI males are first taken in October, stage VI females in November. Note that the summer spawning population has been omitted.



Text-fig. 3. Seasonal distribution of *Loligo* in the English Channel and approaches. The circles correspond to numbers of *L. forbesi*/hour's trawling. •, less than 10/h; ●, 10–24/h; ⬤, > 24/h; O, nil; ▼, *L. vulgaris*.