

# Migrations of Wolffishes, *Anarhichas* sp., from Tagging in the Newfoundland Area

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## Abstract

Tagging of 398 Atlantic wolffish, *Anarhichas lupus*, 81 spotted wolffish, *A. minor*, and 101 northern wolffish, *A. denticulatus*, with Petersen disc tags in the Newfoundland area during 1962-66 yielded 5.0, 7.4 and 3.0% returns respectively. Recapture information indicates that migrations are generally short but some rather long migrations were noted. The rate of recapture of Atlantic wolffish declined rapidly from 15.4% for coastal taggings to 6.7% for offshore taggings except Flemish Cap and to 1.1% for Flemish Cap tagging. Depths of recapture of Atlantic wolffish ranged from 20 to 476 m.

## Introduction

Three species of wolffishes occur in the Northwest Atlantic: Atlantic wolffish, *Anarhichas lupus*, spotted wolffish, *A. minor*, and northern wolffish, *A. denticulatus*. The commercial fishery uses the first two species but the northern wolffish is discarded, when caught, because the flesh is jellied. The wolffishes are usually caught in small numbers in otter-trawl, gillnet and line fisheries directed toward commercially-important groundfishes. In 1981, nominal catches of wolffishes in the Northwest Atlantic totalled 10,196 (metric) tons, of which 3,717 tons were taken off West Greenland (NAFO Subarea 1), 5,638 tons off eastern Canada (Subareas 2, 3 and 4), and 841 tons off northeastern United States (Subareas 5 and 6). In the Canadian region, catches were 129, 2,807 and 2,702 tons from Subareas 2, 3 and 4 respectively. Except for 105 tons reported as Atlantic wolffish from Subarea 2 and 3, wolffishes are not separated in these published statistics (NAFO, 1983). However, Atlantic wolffish constitutes almost all of the wolffish catches in Subareas 4 and 5 (Bigelow and Schroeder, 1953; Scott, 1982), whereas both Atlantic and spotted wolffishes are important in Subareas 1, 2 and 3 (Templeman and Fleming, 1956; Hansen, 1958; Barsukov, 1959; Beese and Kändler, 1969; Albikovskaya, 1982).

Hansen (1958) mentioned that Atlantic and spotted wolffishes were tagged off West Greenland, and Jónsson (1982) reported on extensive tagging of Atlantic wolffish off Iceland. Østvedt (1963) described the migrations of spotted wolffish from tagging in the northern Norwegian and Barents Sea area, and Albikovskaya (1982) referred to tagging of spotted wolffish in the Barents Sea. These taggings showed usually short migrations but occasionally long ones of 200-500 naut. miles, the longest being especially evident in Jónsson's (1982) tagging of *A. lupus* in Icelandic waters.

Because of the lack of information on movements of wolffishes in eastern Canadian waters, some tagging of the three species off Newfoundland (Fig. 1) was carried out during 1962-66.

## Materials and Methods

The wolffish taggings were carried out incidentally to an extensive cod, *Gadus morhua*, tagging program (Templeman, 1979). Fish for tagging were obtained by bottom otter trawls towed for 20-30 min in offshore areas and by bottom longlines set and retrieved on the

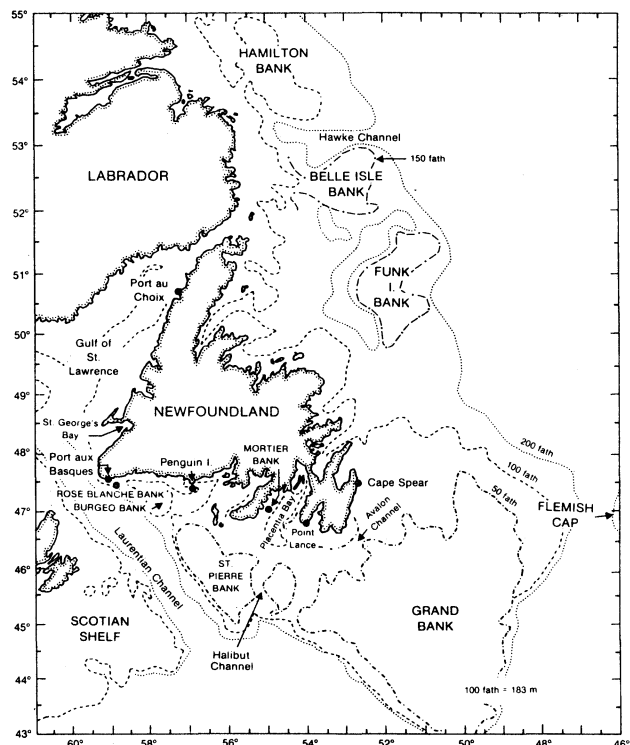


Fig. 1. Map of the study area with place names mentioned in the text.

TABLE 1. General information on tagging of wolffishes in the Newfoundland area, 1962-66. (OT = otter trawl, LL = longline.)

Tagging localities	Positions		Depth range (m)	Months and years of tagging	Gear used	Fish length (cm)	Number of fish tagged	Number recaptured
	N. Lat.	W. Long.						
<b>Atlantic wolffish</b>								
1. Belle Isle Bank to Hamilton Bank	52°04' to 54°51'	53°12' to 54°55'	183-241	1962-66	OT	40-69	111	7
2. Funk Island Bank	51°22'	51°02'	216-236	May 1964	OT	40-74	53	2
3. East Grand Bank	45°45'	48°26'	163-190	Apr 1964	OT	50-79	6	2
4. Flemish Cap	46°54'	44°49'	124-157	May-Jul 1962, 1964	OT	30-89	181	2
5. Point Lance and Cape Spear	46°44' to 47°29'	54°04' to 52°37'	37-146	Sep-Dec 1965	LL	50-84	5	0
6. Mortier Bank	47°01'	55°00'	15-81	Sep-Oct 1965	LL	50-84	26	4
7. Halibut Channel and St. Pierre Bank	45°17' to 46°47'	55°05' to 56°58'	82-157	Jan-May 1963	OT <sup>a</sup>	25-94	8	1
8. Burgeo Bank to St. George's Bay	47°11' to 48°24'	57°42' to 59°42'	99-139	Jan-Mar 1962-63	LL <sup>b</sup>	45-69	8	2
<b>Spotted wolffish</b>								
9. Funk Island Bank to Hamilton Bank	51°22' to 54°51'	51°03' to 55°20'	128-227	Apr-Sep 1962-66	OT	55-109	29	1
10. NE Grand Bank and Flemish Cap	48°16' to 46°53'	50°13' to 44°51'	126-190	Apr-Jul 1964	OT	45-114	28	2
11. NW St. Pierre Bank	46°32'	57°28'	238-247	May 1965	OT	85-89	1	1
12. Penquin Islands, Port aux Basques, and Port au Choix	47°22' to 47°30' to 50°50'	57°00' to 59°11' to 57°20'	51-150	Mar-Sep 1963-64	LL	55-104	23	2
<b>Northern wolffish</b>								
13. Funk Island Bank to Hamilton Bank	51°25' to 54°08'	51°03' to 55°28'	128-136	Apr-Sep 1962-66	OT	60-124	97	3
14. N & E Grand Bank and Halibut Channel	48°15' to 45°20'	48°23' to 55°04'	115-190	Jan-Apr 1963-64	OT	70-104	3	0
15. Port aux Basques	47°33'	59°11'	115-119	Mar 1963	LL	70-74	1	0

<sup>a</sup> 6 tagged from otter-trawl and 2 from longline catches (1 recapture from otter-trawl tagging).

<sup>b</sup> 7 tagged from longline and 1 from otter-trawl catches (2 recaptures from longline tagging).

same day in coastal areas. The greatest total length (cm) was recorded for each fish.

The wolffishes were tagged with white or yellow numbered Petersen-type discs and yellow blanks. Both numbered and unnumbered discs were 12.7 mm diameter and 0.9 mm thick and were attached with 0.81 mm diameter soft stainless steel wire through the flesh in front of the dorsal fin. The address of the Research Station was printed on each numbered disc and a reward of \$1.00 (Canadian) was offered. Detailed information on the taggings is summarized in Table 1. Years after tagging in this paper are actual years from date of tagging, with periods longer than 0.4 year rounded to the nearest whole year, and distances are nautical miles (1 naut. mile = 1° latitude = 1.15 statute miles = 1.85 km).

## Results

From 580 wolffishes tagged during 1962-66, there were 29 reported recaptures, 20 from 398 Atlantic wolffish, 6 (only 3 with precise locations) from 81 spotted wolffish, and 3 from 101 northern wolffish.

There is little evidence of long migrations from the tagging data (Fig. 2), most of the recaptures being made close to the tagging locations. Atlantic wolffish tagged on Mortier Bank in Placentia Bay were recaptured within 2-5 miles of the tagging site after 5-7 years, and recaptures from taggings on Hamilton Bank, Belle Isle Bank, Funk Island Bank, eastern Grand Bank, in Halibut Channel, and on Rose Blanche Bank usually indicated short migrations. Similarly, the small numbers of spotted and northern wolffish recaptures

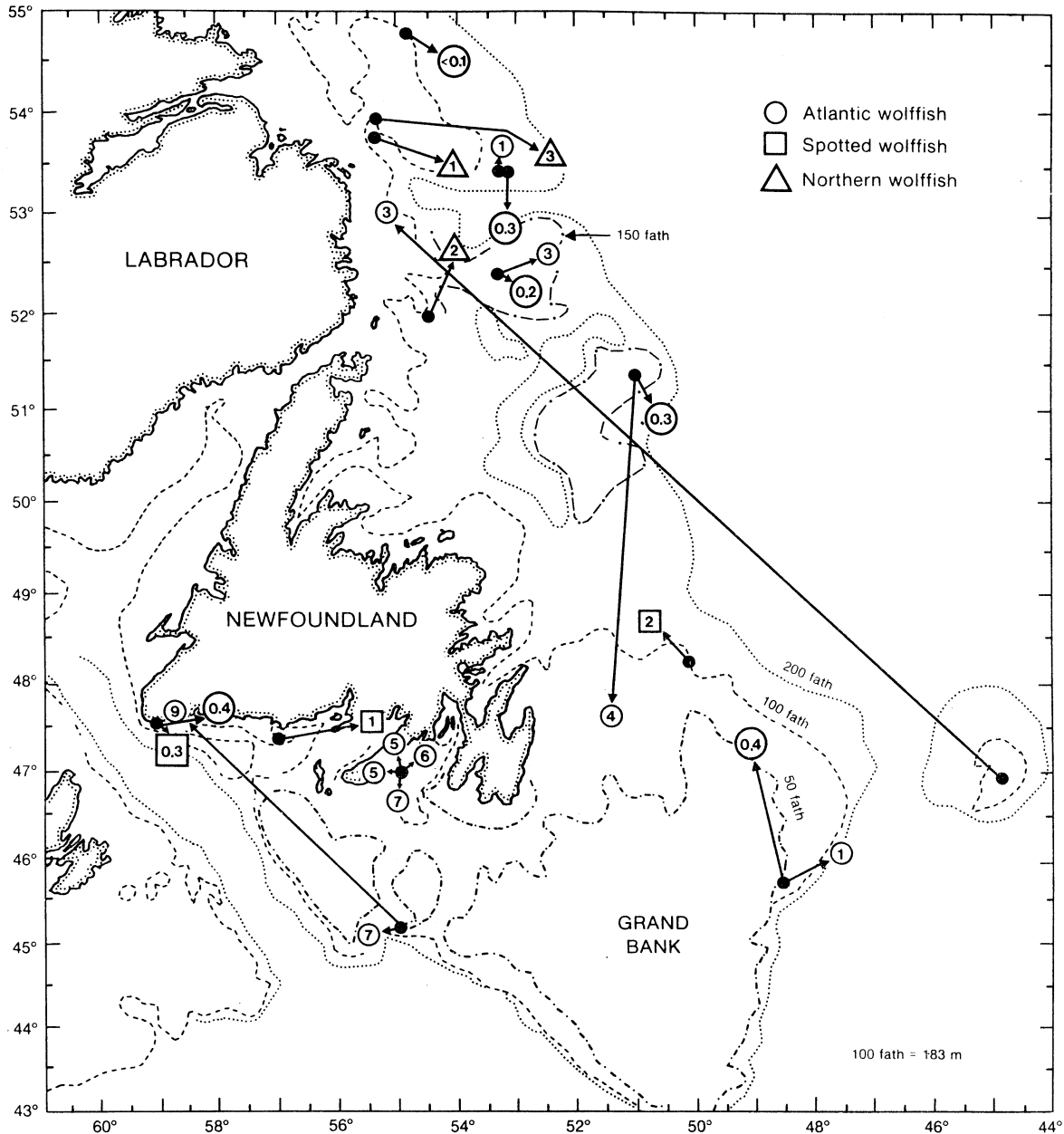


Fig. 2. Migrations of Atlantic, spotted and northern wolffishes tagged in the Newfoundland area. (Solid dots are tagging sites, tips of arrows are positions of recapture, and the numbers in circles, squares and triangles are years between tagging and recapture.)

from taggings at various locations indicated limited movements. However, there were three long migrations of Atlantic wolffish: one from Halibut Channel to southwestern Newfoundland (210 miles), one from Funk Island Bank to the Avalon Channel off Cape Spear (210 miles), and one from Flemish Cap to southern Labrador (530 miles).

For Atlantic wolffish, the return rates were 15.4% for tagging in coastal waters, 6.7% for tagging in offshore areas except Flemish Cap, and 1.1% for tagging on Flemish Cap, the overall percentage being 5.0% (Table 2). The overall percentage returns by length-

groups of the fish when tagged were similar (5.4–7.1%) for 40–49, 50–59 and 60–69 cm groups but decreased sharply to 3.5 and 0% for the 70–79 and 80–94 cm groups respectively. However, the overall percentage returns for the 60–69 and 70–79 cm groups are greatly affected by the small number of returns from Flemish Cap relative to the higher proportions of fish tagged there than in coastal and other offshore areas.

Recaptures of Atlantic wolffish in the calendar year of tagging and in 1–5 and 6–10 years after tagging were 1.5, 2.3 and 1.3% respectively. Recaptures were well distributed over depths down to 300 m: 4 from

TABLE 2. Tagging and recapture data for Atlantic wolffish in the Newfoundland area by size-group at the time of tagging.

Length group (cm)	Number tagged			Percentage recaptured			
	CO <sup>a</sup>	OS <sup>b</sup>	FC <sup>c</sup>	CO <sup>a</sup>	OS <sup>b</sup>	FC <sup>c</sup>	Total
25-39	—	2	1	—	—	—	—
40-49	1	54	1	—	5.6	—	5.4
50-59	3	78	3	—	7.6	—	7.1
60-69	17	35	56	23.5	5.7	1.8	6.5
70-79	13	7	95	15.4	14.2	1.1	3.5
80-94	5	2	25	—	—	—	—
Total	39	178	181	15.4	6.7	1.1	5.0

<sup>a</sup> Coastal (No. 5, 6 and 8 of Table 1).

<sup>b</sup> Offshore (No. 1, 2, 3 and 7 of Table 1).

<sup>c</sup> Flemish Cap (No. 4 of Table 1).

20-60 m, 3 from 61-120 m, 2 from 121-180 m, 4 from 181-240 m, and 3 from 241-300 m. There was one recapture in 476 m.

## Discussion

The usually short migrations of wolffish, with occasionally longer ones, reported in this paper, are similar to the reports of tagging by Ostvedt (1963), Smidt (1981) and Albikovskaya (1982) for *A. minor*, and presumably similar to those reported by Jónsson (1982) for *A. lupus* in Iceland waters, although this author presented only the relatively small number of long migrations from a much larger number of recaptures.

The small number of recaptures over many years in the present study precludes any attempt to detect seasonal movements, and the lack of information on spawning grounds of wolffish in the Newfoundland area provides no basis for relating migrations to spawning. However, there is evidence of seasonal inshore-offshore migrations of *A. lupus* in Icelandic waters, involving movements from shallow water to deeper spawning areas where they remain from September to December or January and subsequent return to shallow areas for feeding, with sometimes long coastal movements to or away from spawning grounds (Jónsson, 1982). Inshore migration of Atlantic wolffish in May and June has been noted off Southwest Nova Scotia (Kohler, 1968).

The wolffishes lay large eggs demersally (McKenzie and Homans, 1938; Jensen, 1948; Barsukov, 1959; Powles, 1967; Hansen, 1968) and the larvae are pelagic. The prespawning adults, therefore, do not need to migrate as far contranantantly as the cod of the Labrador-East Newfoundland stock complex (Templeman, 1979, 1981), whose eggs may drift hundreds of miles before hatching and whose larvae after hatching are much smaller and thus have a longer pelagic life

than wolffish larvae. It would be surprising, however, if there were no contranant migrations of adult wolffish to counteract the denatant movements of the larvae before they settle to the bottom. This may be the case especially for *A. denticulatus* which as young fish are pelagic and are caught rarely in bottom trawls but are found in fish stomachs (Kotthaus and Kreffft, 1957; Beese and Kändler, 1969).

Depth ranges for the Atlantic wolffish were listed as 2-435 m by Barsukov (1959), from <100 to 400-500 m in trawl surveys by Federal Republic of Germany research vessels which fished to 840 m (Beese and Kändler, 1969), and from <50 to 551-600 m in the Newfoundland area (Albikovskaya, 1982). The depth range of 20-476 m noted in the present paper was undoubtedly affected by the small number of recaptures in offshore areas.

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