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Wolffish (*Anarhichas* sp.) landings in the estuary and Gulf of St. Lawrence (1960–2009) recorded in commercial fisheries statistics

Débarquements de loups (*Anarhichas* sp.) dans l'estuaire et le golfe du Saint-Laurent (1960–2009) selon les statistiques de pêche commerciale

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ABSTRACT

Commercial landings data for the wolffishes (*Anarhichas denticulatus*, *Anarhichas minor* and *Anarhichas lupus*) were compiled from Northwest Atlantic Fisheries Organization (NAFO) and Zonal Interchange File Format (ZIFF) files for NAFO divisions 4RST. In both datasets, the landing data were not broken down by species for the period from 1960 to 2004, which precludes species-specific analyses. Since 2005, most landing reports have identified the species landed but fishermen have only been permitted to land Atlantic wolffish (*A. lupus*). The NAFO statistics indicate that wolffish landings in NAFO divisions 4RST averaged 216 metric tons per year during the period 1960–1998 and the ZIFF statistics indicate an average of 100 metric tons per year during the time period 1985-2009. The reported landings of wolffish occurred mainly during fishing activities directed toward Atlantic cod (*Gadus morhua*) and 3 species of flatfish. In the ZIFF statistics, the majority of the landings were from division 4R (80.7% of total landed catch in weight, with 13.1% from 4S and only 6.1% from 4T). Sub-divisions 4Rb, 4Rc and 4Rd were the hotspots with an average landed catch of 2,112 kg per year per 1,000 km^2 for the three species and three sub-divisions combined. Throughout the time series covered by the NAFO statistics (1960–1998) hook and line gears, primarily longlines, were the most important gears followed by bottom trawls. In the ZIFF statistics, which cover a more recent time period than the NAFO statistics (i.e., 1985–2009), longlines and gillnets collectively contributed two thirds of the total number of reports of wolffish landings with longlines accounting for as much as 72.0% of the total landed catch in weight. There was a significant negative trend in LPUE over the period from 1985 to 2009 in 4RST; a similar pattern was observed in the three sub-divisions where longline landings and LPUE were greatest (4Rb, 4Rc, and 4Rd).

RÉSUMÉ

Les statistiques de pêche commerciale de loups (*Anarhichas denticulatus*, *Anarhichas minor* et *Anarhichas lupus*) ont été compilées à partir des fichiers de l'Organisation des Pêches de l'Atlantique Nord-Ouest (OPANO) et des fichiers ZIFF (Zonal Interchange File Format) pour les divisions 4RST de l'OPANO. Dans ces statistiques, on ne distingue pas les espèces, du moins dans la période de 1960 à 2004, ce qui ne permet pas une analyse des statistiques par espèce. À partir de 2005, seul le loup atlantique (*A. lupus*) pouvait être débarqué. Selon les statistiques de l'OPANO, les débarquements de loup ont été en moyenne de 216 tonnes métriques par année entre 1960 et 1998, alors que selon les fichiers ZIFF ils ont été de 100 tonnes métriques par année entre 1985 et 2009 dans les divisions 4RST. Ces débarquements ont surtout été le fruit d'activités de pêche à la morue (*Gadus morhua*) ou à trois espèces de poisson plat. Selon les fichiers ZIFF, les loups débarqués ont été capturés principalement dans 4R (80.7% des poids débarqués), peu dans 4S (13.1%) ou dans 4T (6.1%). Les sous-divisions 4Rb, 4Rc et 4Rd ont été des hauts lieux avec en moyenne des débarquements de 2,112 kg par année par 1,000 km^2 pour les trois espèces et les trois sous-divisions combinées. De 1960 à 1998 (statistiques de l'OPANO), les palangres et dans une moindre mesure les chaluts ont été responsables de la majorité des captures. Plus récemment (selon les fichiers ZIFF, 1985 à 2009), les palangres et les filets maillants ont été responsables des deux tiers des mentions de captures dans les rapports de débarquement, mais les palangres à elles seules ont été responsables de 72% des poids débarqués. On note une diminution significative des débarquements entre 1985 et 2009 dans 4RST. Cette situation prévaut également pour les palangriers là où les poids débarqués ont été les plus élevés (4Rb, 4Rc et 4Rd).

INTRODUCTION

Concerns about the status of the three species of wolffish that inhabit the east coast of Canada resulted in the listing of two of them (*Anarhichas denticulatus*, the northern wolffish, and *Anarhichas minor*, the spotted wolffish) as 'threatened' under the Species at Risk Act (SARA). The third species (*Anarhichas lupus*, the Atlantic wolffish) was listed as 'special concern'. A national recovery plan was established in 2003 for the northern and spotted wolffishes and management measures (i.e. management plan) were implemented to protect the Atlantic wolffish. Detailed and reliable data on the distribution and relative abundance of wolffish in the estuary and Gulf of St. Lawrence is available through the annual DFO bottom-trawl surveys, as well as from DFO's Sentinel and Observer programs. However, information from the commercial fisheries (e.g. landings, fishing gears, fishing areas, fishing behaviors, etc.) must also be taken into consideration when the status of these resources is assessed, and more particularly when management measures are recommended. In order to be informative, this data must satisfy a certain number of essential conditions: catches must be reported at the species level; the data must be explicit as to how fishes were caught and with some means of assessing fishing effort; the data must identify the time and location of catches at a suitable level of resolution. Commercial landings data for wolffish fail to meet many of these conditions, but may nevertheless provide useful information as regards to the impact of human activities.

Status reports and associated research documents published when the status of the three species was being assessed by COSEWIC give a detailed account of data available up to 2000 with an emphasis on Atlantic wolffish and NAFO divisions 4 and 5 (McRuer et al. 2000), and the three species in waters around Newfoundland, excluding the Gulf of St. Lawrence (Simpson and Kulka 2002). Kulka et al. (2004) analyzed population trends as well as distribution and habitat associations of wolffish in the "center of distribution" of the species, referring to the Labrador Shelf and Grand Banks, but did not consider the Gulf of St. Lawrence and areas south of Newfoundland in their analysis. Kulka et al. (2007) summarized the available information on the three species in Canadian waters in the recovery strategy and management plan. Data on the distribution and relative abundance of wolffish in the estuary and Gulf of St. Lawrence from DFO's annual bottom-trawl surveys and Sentinel and Observer programs were examined in a separate report (Dutil et al. 2010). The present report describes the fisheries responsible for wolffish landings in NAFO divisions 4R, 4S and 4T, and illustrates how the landings have changed over time.

MATERIALS AND METHODS

Commercial landings data for wolffish were compiled from the Northwest Atlantic Fisheries Organization (NAFO) and Zonal Interchange File Format (ZIFF) files. Landing reports for wolffish in the NAFO divisions located in the study area (4RST) were selected (Figure 1). Throughout this document, a landing refers to an event where fish were landed by a vessel upon its return from a fishing trip. Because fishing trips may last for several days during which the vessel may visit several NAFO sub-divisions, a landing may be further subdivided into multiple landing reports. A landing report is a subset of the landing and represents a lower level of resolution or disaggregation of the landing (e.g. where the landing was disaggregated on the basis of NAFO sub-division, date of capture, form of the fish at landing etc.).

DATA AVAILABLE

The NAFO Table 5 files contain monthly commercial fishery landings and fishing effort for both domestic and foreign vessels and cover the period from 1960–1999. The files for 1999 are clearly incomplete and may also be incomplete for some other years in the late 1990's but we decided to examine data for the period from 1960–1998 (Table 1). In these files the wolffish landings are not separated by species (i.e., all species are combined under the name wolffishes, or catfishes, and are represented by code 188).

The ZIFF files contain 47,983 data lines with information on catches of wolffish (= n of reports), corresponding to 39,667 different landings during the period from 1985 to 2009 (Table 2; as of April 15, 2010). Some landings included multiple reports (up to 59). Aggregating reports in landings results in a loss of information because landings that represented multiple reports involved the use of more than one fishing gear and may have occurred in a variety of NAFO divisions. The information on vessel was lacking in 2,780 reports; when this occurred on the same date, these reports were considered to represent a single landing.

LANDINGS – METHODOLOGY

In the NAFO Table 5 files, the landings are referred to as "nominal catches" and represent the live weight equivalent (LWE) of the landings (in metric tons).

In the ZIFF files, both the landed weight (variable PD_DEB in the database) and the equivalent live weight of the landings (variable PDS_VIF in the database) provide information on the landed weight of the catch. Landed weight represents the biomass of wolffish in the form that they were landed in (Table 3).Thus it does not fully account for the total weight of the catch which can be obtained using equations presented in Table 4. Most of the fish landed were processed at sea but information on the form was often lacking (Table 3). The live weight equivalent (LWE) is the variable that best accounts for the weight of the catch. The LWE was lacking in 1,820 reports, nearly 4% of the total number. Their occurrence by year (Table 5), NAFO sub-division (Table 6), and fishing gear (Table 7), is shown for information. The 1,820 reports with missing live weight data were not included in the analyses based on LWE.

The landings data in the ZIFF files do not account for the amount of biomass possibly discarded at sea. Time trends in landings and discards in the study area were compared using data from the Observer program (data from Biorex exclusively) for the period from 1996 to 2009. They were examined for all NAFO sub-divisions combined, and for a subset of NAFO sub-divisions where catches were greatest. Longline reports for which the LWE was > 0 were summed by year and by NAFO sub-division. Few data were available to assess the actual fishing effort associated with a given landing report. The number of reports was used as a proxy for fishing effort. Data were standardized by sub-division, by subtracting the mean annual value for the sub-division from each annual observation and dividing the difference by the standard deviation of observations for that sub-division. Thus positive observations represent above average years and negative observations represent below average years for the period considered. Piecewise, two-segment linear regressions of landings per unit of effort (LPUE) and year were performed on log-transformed data (variable plus a constant value – 2).

RESULTS AND DISCUSSION

LANDINGS BY SPECIES AND YEAR

The landings of wolffish were not recorded by species in any of the NAFO Table 5 statistics (for the period 1960–1998; Table 1) or in the ZIFF files (for the period 1985-2004;Table 8). Therefore, these data cannot be used to examine time trends in the landings by species for the period from 1960 to 2004. Since 2005, most ZIFF reports have identified the species landed, but fishermen have only been allowed to land Atlantic wolffish.

The year of landing was available for all of the ZIFF reports, but 1,820 reports lacked a LWE value. These cases were included in the columns “Number of reports” but they did not contribute to the LWE. The number of reports was generally in the range of 2,000-3,000 per year until 2002 and dropped to below 1,000 per year after SARA was enforced and the two species were listed. There was a concurrent decrease in the landed catch in weight, but potential changes in gear and effort were not taken into consideration in these figures.

The NAFO statistics indicate that 8,409 metric tons (LWE) of wolffish were landed in NAFO divisions 4RST during the period from 1960–1998 which corresponds to an average of 216 metric tons per year (Table 1). In the ZIFF files, the LWE summed to 2,500 metric tons over 25 years, representing 100 tons per year in the study area. The surface area of NAFO divisions 4R, 4S and 4T is roughly 251,783 km^2 which would indicate an average landed catch of only 400 kg per year per 1,000 km^2 for the three species combined. Catches expressed per unit of surface area (per 1,000 km^2) must be interpreted with caution, however. NAFO divisions 4R, 4S and 4T differ in surface area, but within each division fishing activities are spatially aggregated. The surface area actually covered within a division varies between fisheries and may represent different proportions of the total surface area in different divisions.

LANDINGS BY TARGET AND MAIN SPECIES LANDED

The reported landings of wolffish during the period from 1985 to 2009 occurred mainly during fishing activities directed towards Atlantic cod and 3 species of flatfish (representing 85% of the reports and 95% of the reported total landed weight of wolffish, for reports with main target species or group of species specified). Only 1.8% of the reports and 1.2% of the total landed weight of wolffish, for reports with the main target species or group of species specified, occurred during fishing activities where wolffish were the target species (Tables 9 and 10). The target species was not identified in nearly half of the reports (46%) and for 60% of the total landed catch in weight of wolffish. When examined by main species landed, no major differences were observed (Tables 11 and 12).

LANDINGS BY PORT AND NAFO DIVISION

Whereas the NAFO division was identified on all landings and landing reports, the NAFO sub-division was missing in some cases. The number of reports and corresponding LWE for which the NAFO sub-division was not specified were: 960 reports and 41,049 kg for 4R, 13 reports and 1,019 kg for 4S, and 436 reports and 11,274 kg for 4T. Precise coordinates of the catches made by smaller vessels are not available in logbooks. The exact location of catches within the sub-divisions could not be determined in most cases. Out of 47,983 reports, there were only 6,437 reports with latitude and longitude observations. ZIFF landing reports were recorded in 5 provinces.

The NAFO statistics (Table 1) show that the majority of the wolffish landings for the time period from 1960 -1998 (71.0%) were recorded in division 4R with lesser quantities landed in divisions 4S and 4T (16.4% and 12.6%, respectively). The ZIFF data (for the time period 1985-2009) indicate that the wolffish landings occurred primarily in division 4R (80.7% of the total landed catch in weight), 13.1% came from 4S and only 6.1% came from 4T. The surface area of NAFO divisions 4R, 4S and 4T is roughly 41,007, 90,059 and 120,717 km^2, respectively, which would indicate an average landed catch of 1,928 kg per year per 1,000 km^2 in 4R for the three species combined, compared to only 142 kg and 50 kg per year per 1,000 km^2 in 4S and 4T, respectively. In 4R, sub-divisions 4Rb, 4Rc and 4Rd were hotspots yielding 73.1% of all reports in which sub-division was not missing, and 74.4% of the total landed catch in weight in the study area (Tables 13 and 14). The total surface area of NAFO sub-divisions 4Rb, 4Rc and 4Rd is roughly 32,238 km^2 (11,167 for 4Rb, 14,144 for 4Rc, and 6,927 km^2 for 4Rd) which would indicate an average landed catch of 2,112 kg per year per 1,000 km^2 for the three species and three sub-divisions combined. Among these hotspots, the landed catch per 1,000 km^2 for the three species combined was lowest in 4Rc at 1.595 tons per year, intermediate in 4Rb at 2.565 tons per year, and highest in 4Rd at 2.901 tons per year).

Most of the reports (78%) and most of the total landed catch in weight (77%) occurred in Newfoundland (Table 15). Four ports located in Newfoundland (Port au Choix, Port Saunders, Codroy and Trout River) were most active in terms of the number of reports (42% of the reports corresponding to 34% of the total landed catch in weight; Table 16). Three of those ports (Port au Choix, Codroy and Trout River) and Rivière-au-Renard (QC) were most active in terms of total landings (36% of total landed catch in weight corresponding to 33% of the reports; Table 17).

LANDINGS BY GEAR

Throughout the time series covered by the NAFO statistics (1960–1998) hook and line gears, primarily longlines, were the most important gears (45.7% of total landings) followed by bottom trawls (38.5%), with gillnets and seines accounting for much smaller proportions of the total landings (9.5% and 2.4% respectively; Figure 2). In the ZIFF statistics, which cover a more recent time period than the NAFO statistics (i.e. 1985–2009), longlines and gillnets collectively contributed two thirds of the total number of reports of wolffish landings (Table 18). Bottom trawl (stern), shrimp trawl and Danish seines in conjunction with longlines and gillnets accounted for 95% of the total number of reports of wolffish landings. Longlines were by far the most important gear and were responsible for 72.0% of the total landed weight of wolffish (Table 19).

REPORTS WHICH IDENTIFIED WOLFFISH AS TARGET SPECIES

In the ZIFF data, wolffish were identified as the target species in only 466 reports that were associated with 449 landings (Tables 9 and 10). These landings represented a total of 11,562 kg (LWE) of wolffish. Wolffish directed fishing took place in 1991, 1993, 1994, 1995, and 1997 to 2003. The landings of wolffish were greatest in 1993 (71% of total LWE for wolffish directed fishing), 1998 (9%) and 1999 (15%), and originated mainly from NAFO sub-divisions 4Rc (34% of total LWE for wolffish directed fishing) and 4Rd (48%). The other sub-divisions included 4Ra, 4Rb, 4Ss and 4Tf. Only 5 cases were geo-referenced with latitude and longitude values and an additional one with a fishing area code. The landed catches resulting from this wolffish directed activity were landed in 47 ports, including 44 located in Newfoundland and 3 located in NS as the only exceptions. Twenty-five percent of the LWE was landed in the port of Codroy (NF), which is located in NAFO sub-division 4Rd. In total, 174 vessels declared that they

targetted wolffish; landed weight of wolffish represented less than 5% of the total landed weight (LWE) associated with directed fishing. The fishing gears involved were mostly longlines and gillnets accounting for 55% and 36% of the total LWE, respectively. Other gears included trap nets, hand lines, pots, jiggers, bottom otter trawls and Danish seines with each one contributing 5% or less to the total landings (LWE).

TEMPORAL TRENDS IN LANDINGS

During the time period covered by the NAFO data (1960–1998), the annual landings of wolffish in NAFO divisions 4RST grew steadily throughout the 1960's to a peak in 1970 (525 metric tons), declined gradually for several years before increasing to a maximum in 1983 (742 metric tons), and then declined to low values in the mid-1990's (Figure 2). This pattern was primarily driven by the trend in landings in NAFO division 4R which was responsible for the majority of the landings (71%) during this time period.

The longline fishery data were examined in more detail in order to determine whether landings and landings weighted by the effort dropped during the period from 1985 to 2009. The yearly landings of wolffish caught by longlines were quite variable in the periods from 1985 to 1993 and 1997 to 2002, with below-average landings recorded during the cod fishing moratorium in the mid-90s and after the spotted and northern wolffish were protected under SARA (Figure 3). These trends were also apparent when the data were weighted by a crude measure of the fishing effort (Figure 4). Despite this large variability in the landings and LPUE, there was a significant negative trend over the period from 1985 to 1996 in LPUE ($P < 0.001$, $r^2 = 0.39$) (Figure 5). In the three sub-divisions where longline landings and LPUE were greatest (4Rb, 4Rc, and 4Rd), similar patterns were observed (Figures 6 and 7) with a significant negative trend over the period from 1985 to 1996 in LPUE ($P = 0.001$, $r^2 = 0.45$) (Figure 8). Whether this negative trend resulted from decreased abundance over time is unknown. Below average landings and LPUE observed in the late 90s persisted during the period from 2000 to 2009. Furthermore, based on data from the Observer Program (1,439 observations between 1996 and 2009), there was a clear indication that wolffish landings represented a large proportion of the reported catches until 2004 (Figure 9). In contrast, they represented only a minor fraction of the reported catches starting in 2005, which again would tend to decrease the negative trend over time. The data did not indicate any increase in LPUE (for Atlantic wolffish) post-SARA.

SUMMARY AND CONCLUSIONS

The main conclusions that can be drawn from each sub-section in this analysis are summarized below in point form. These points should be taken as a guide when setting up monitoring and control measures aimed at protecting and rehabilitating wolffish in the Gulf of St. Lawrence, with the caveat that only limited information is available at the species level in the NAFO and ZIFF files.

- NAFO and ZIFF files do not allow for species-specific analyses of the landings of wolffish in NAFO divisions 4RST.

- Spatial resolution of landed catches is poor in the ZIFF files and nonexistent in the NAFO files. This prevents geospatial analyses of the data.

- The NAFO statistics indicate that wolffish landings in NAFO divisions 4RST averaged 216 metric tons per year during the period 1960–1998 and the ZIFF statistics indicate an average of 100 metric tons per year during the period 1985–2009.

- Wolffish were caught mainly by cod-directed fishing activities (80% of LWE), and to a lesser extent by flatfish-directed fishing activities (American plaice, Witch flounder and Atlantic halibut).

- Throughout the time series covered by the NAFO statistics (1960–1998) hook and line gears, primarily longlines, were the most important gears followed by bottom trawls. In the ZIFF statistics, which cover a more recent time period than the NAFO statistics (i.e. 1985–2009), longlines and gillnets collectively contributed two thirds of the total number of reports of wolffish landings.

- In the ZIFF statistics, reported catches of wolffish occurred mainly in division 4R (80% of LWE, 1,928 kg per year per 1,000 km2), sub-divisions 4Rbcd (2,901 kg per year per 1,000 km2 in 4Rd), and were landed mainly in Newfoundland (77% of LWE).

- Wolffish-targeted fisheries were not very important (landings <12 metric tons) in terms of the total landed biomass in 4RST between 1985 and 2009.

- Wolffish-targeted fisheries used longlines and gillnets, occurred mainly in sub-division 4Rc, and were landed mainly in Codroy (NF).

- Landings and landings per unit effort decreased over time during the period from 1985 to 1996 and remained low thereafter. There is no indication of an increase in recent years.

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Table 1. Reported landings (metric tons) of wolffishes (species unspecified, NAFO code 188) in NAFO divisions 4RST (1960 – 1998) as recorded in NAFO Table 5 landing statistics.

Year	4R	4S	4T	Total
1960	6	5	4	15
1961	5	1	2	8
1962	14	23	17	54
1963	8	25	29	62
1964	29	74	66	169
1965	16		6	22
1966	53		4	57
1967	41	20	49	110
1968	117	13	70	200
1969	234	59	52	345
1970	378	61	86	525
1971	270	57	86	413
1972	195	54	69	318
1973	180	58	51	289
1974	220	69	53	342
1975	148	68	43	259
1976	153	12	43	208
1977	296	16	10	322
1978	134	14	9	157
1979	169	25	18	212
1980	212	113	19	344
1981	247	101	42	390
1982	276	119	20	415
1983	567	97	78	742
1984	467	14	24	505
1985	282	14	6	302
1986	318	44	26	388
1987	167	65	18	250
1988	92	35	4	131
1989	96	37	5	138
1990	114	40	19	173
1991	119	32	7	158
1992	102	9	8	119
1993	98	5	4	107
1994	7		1	8
1995	13			13
1996	7		7	14
1997	71	2		73
1998	51		1	52
Total 1960–1998:	5,972	1,381	1,056	8,409
Average 1960–1998:	153	42	29	216
Percentage 1960–1998:	71.0	16.4	12.6	

Table 2. Number of cases after ZIFF data were sorted by date and vessel (variable CFVN in the database). A landing is defined as one or multiple reports involving one vessel on a single day.

Total number of lines in the original database = n reports	47,983
Number of unique combinations of DATE and CFVN = n landings	39,666
Difference = number of multiple reports	8,317
Maximum number of reports in a single landing	59
Minimum number of reports in a single landing	1
Mean number of reports per landing	1.21
Standard deviation of the number of reports per landing	1.25

Table 3. Number of reports according to the form of the fish at landing.

Form	Form code	Number of reports	
		absolute	relative, %
Head-on gutted	2	24,279	50.6
Intact	1	6,361	13.2
Head-off gutted	3	81	0.2
Not specified	0	17,262	36.0
Total		47,983	

Table 4. Parameters describing the linear regression relating live weight to landed weight in the four landed form categories in ZIFF files. Regression parameters were back-calculated from observations in the database.

LWE = a * landed weight + b						
Form code	coefficient a		constant b		r	n
	value	p	value	p		
0	1.146	< 0.001	1.111	< 0.001	0.993	15,410
1	1.007	< 0.001	-0.004	0.904	1.000	6,116
2	1.206	< 0.001	-0.844	< 0.001	1.000	23,398
3	1.607	< 0.001	-1.909	< 0.001	1.000	81

Table 5. Number of reports missing a LWE value according to year.

Year	n reports		Year	n reports		Year	n reports	
	abs	rel. %		abs	rel. %		abs	rel. %
1985	8	0.4	1994	274	15.1	2002	93	5.1
1986	13	0.7	1995	11	0.6	2003	31	1.7
1987	14	0.8	1996	11	0.6	2004	13	0.7
1988	37	2.0	1997	67	3.7	2005	435	23.9
1989	21	1.2	1998	27	1.5	2006	16	0.9
1990	117	6.4	1999	136	7.5	2007	11	0.6
1991	80	4.4	2000	126	6.9	2008	16	0.9
1992	57	3.1	2001	139	7.6	2009	7	0.4
1993	60	3.3						

Table 6. Number of reports missing a LWE value according to NAFO sub-division and sorted by decreasing number of reports.

Sub-division	n reports		Sub-division	n reports	
	abs	rel. %		abs	rel. %
4Rd	763	42.3	4Ra	20	1.1
4Tf	360	20.0	4Tk	18	1.0
4Rb	222	12.3	4Tl	16	0.9
4Rc	176	9.8	4Sx	14	0.8
4Ss	144	8.0	4Tn	5	0.3
4Tg	44	2.4	4To	2	0.1
4Sv	20	1.1			

Table 7. Number of reports missing a LWE value according to fishing gear and sorted by decreasing number of reports.

Gear	Gear code	n reports	
		abs	rel. %
Bottom otter trawl (stern)	12	687	37.8
Danish seine	21	514	28.3
Longline	51	216	11.9
Gillnet (set or fixed)	41	118	6.5
Midwater trawl (stern)	15	86	4.7
Pot	62	68	3.7
Shrimp trawl	19	65	3.6
Scottish seine	22	36	2.0
Hand line (baited)	59	17	0.9
Bottom otter trawl (side)	11	8	0.4
Jigger	53	4	0.2

Table 8. Live weight (LWE, metric tons) and number of reports of Atlantic wolffish (Anarhichas lupus), spotted wolffish (Anarhichas minor), and undetermined wolffish (Anarhichas sp.) in the study area (NAFO divisions 4RST) from 1985 to 2009. NA, not available.

Year	Atlantic wolffish		Spotted wolffish		Undetermined wolffish		Total	
	LWE	Number of reports	LWE	Number of reports	LWE	Number of reports	LWE	Number of reports
1985					320.8	2,606	320.8	2,606
1986					400.3	2,858	400.3	2,858
1987					267.2	3,571	267.2	3,571
1988					146.8	2,254	146.8	2,254
1989					128.3	1,969	128.3	1,969
1990					166.6	2,329	166.6	2,329
1991					166.8	2,773	166.8	2,773
1992					115.9	2,165	115.9	2,165
1993					112.7	3,680	112.7	3,680
1994					10.3	1,058	10.3	1,058
1995					13.6	731	13.6	731
1996					15.1	738	15.1	738
1997					73.8	2,795	73.8	2,795
1998					55.0	2,101	55.0	2,101
1999					80.9	3,441	80.9	3,441
2000					96.1	3,471	96.1	3,471
2001					94.5	3,082	94.5	3,082
2002					96.5	3,059	96.5	3,059
2003					15.3	637	15.3	637
2004					7.6	218	7.6	218
2005	7.3	544	NA	46	0.7	43	8.0	633
2006	7.7	292	NA	4	0.3	20	8.0	316
2007	11.4	372			0.3	22	11.7	394
2008	17.5	555			3.4	24	20.9	579
2009	16.2	509			0.4	16	16.6	525
Total	60.0	2,272	NA	50	2,389.0	45,661	2,449.1	47,983

Table 9. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, according to the main species sought during the fishing activity. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Species are sorted by decreasing number of reports.

Main species sought	Species code	Number of reports			LWE		
		absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
Atlantic cod	100	16,960	35.3	35.3	782,526	32.0	32.0
American plaice	140	2,160	4.5	39.8	51,518	2.1	34.1
Greysole (Witch)	142	1,774	3.7	43.5	36,786	1.5	35.6
Atlantic halibut	130	1,500	3.1	46.7	48,186	2.0	37.5
Redfish sp.	120	1,433	3.0	49.7	10,589	0.4	38.0
Shrimp sp.	702	559	1.2	50.8	6,783	0.3	38.2
Wolffish sp.	174	466	1.0	51.8	11,562	0.5	38.7
Greenland halibut	144	466	1.0	52.8	5,708	0.2	38.9
Lumpfish roe	928	373	0.8	53.5	2,822	0.1	39.1
Snow crab	705	190	0.4	53.9	1,338	0.1	39.1
Winter flounder	143	67	0.1	54.1	728	< 0.1	39.1
Skate	160	46	0.1	54.2	348	< 0.1	39.2
White hake	171	39	0.1	54.3	559	< 0.1	39.2
Haddock	110	22	< 0.1	54.3	542	< 0.1	39.2
Lumpfish	176	19	< 0.1	54.3	109	< 0.1	39.2
Lobster	700	15	< 0.1	54.4	64	< 0.1	39.2
Pollock	170	9	< 0.1	54.4	56	< 0.1	39.2
Skate sp.	356	3	< 0.1	54.4	19	< 0.1	39.2
Mackerel	250	2	< 0.1	54.4	47	< 0.1	39.2
Spiny dogfish	362	2	< 0.1	54.4	25	< 0.1	39.2
Cusk	173	1	< 0.1	54.4	49	< 0.1	39.2
Rock eel/Snake blenny	186	1	< 0.1	54.4	7	< 0.1	39.2
Yellowtail	141	1	< 0.1	54.4	4	< 0.1	39.2
Monkfish	177	1	< 0.1	54.4	2	< 0.1	39.2
Silver hake	172	1	< 0.1	54.4	1	< 0.1	39.2
Roundnose grenadier	179	1	< 0.1	54.4	0	< 0.1	39.2
Unspecified flounders	149	17	< 0.1	54.5	40	< 0.1	39.2
Unspecified groundfish	199	238	0.5	54.9	11,130	0.5	39.7
Unspecified	999	21,617	45.1	100.0	1,477,533	60.3	100.0
Total		47,983	100.0		2,449,081	100.0	

Table 10. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, according to the main species sought during the fishing activity. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Species are sorted by decreasing LWE.

Main species sought	Species code	Number of reports			LWE		
		absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
Atlantic cod	100	16,960	35.3	35.3	782,526	32.0	32.0
American plaice	140	2,160	4.5	39.8	51,518	2.1	34.1
Atlantic halibut	130	1,500	3.1	43.0	48,186	2.0	36.0
Greysole (Witch)	142	1,774	3.7	46.7	36,786	1.5	37.5
Wolffish sp.	174	466	1.0	47.6	11,562	0.5	38.0
Redfish sp.	120	1,433	3.0	50.6	10,589	0.4	38.4
Shrimp sp.	702	559	1.2	51.8	6,783	0.3	38.7
Greenland halibut	144	466	1.0	52.8	5,708	0.2	38.9
Lumpfish roe	928	373	0.8	53.5	2,822	0.1	39.1
Snow crab	705	190	0.4	53.9	1,338	0.1	39.1
Winter flounder	143	67	0.1	54.1	728	<0.1	39.1
White hake	171	39	0.1	54.2	559	<0.1	39.2
Haddock	110	22	<0.1	54.2	542	<0.1	39.2
Skate	160	46	0.1	54.3	348	<0.1	39.2
Lumpfish	176	19	<0.1	54.3	109	<0.1	39.2
Lobster	700	15	<0.1	54.4	64	<0.1	39.2
Pollock	170	9	<0.1	54.4	56	<0.1	39.2
Cusk	173	1	<0.1	54.4	49	<0.1	39.2
Mackerel	250	2	<0.1	54.4	47	<0.1	39.2
Spiny dogfish	362	2	<0.1	54.4	25	<0.1	39.2
Skate sp.	356	3	<0.1	54.4	19	<0.1	39.2
Rock eel/Snake blenny	186	1	<0.1	54.4	7	<0.1	39.2
Yellowtail	141	1	<0.1	54.4	4	<0.1	39.2
Monkfish	177	1	<0.1	54.4	2	<0.1	39.2
Silver hake	172	1	<0.1	54.4	1	<0.1	39.2
Roundnose grenadier	179	1	<0.1	54.4	0	<0.1	39.2
Unspecified flounders	149	17	<0.1	54.5	40	<0.1	39.2
Unspecified groundfish	199	238	0.5	54.9	11,130	0.5	39.7
Unspecified	999	21,617	45.1	100.0	1,477,533	60.3	100.0
Total		47,983	100.0		2,449,081	100.0	

Table 11. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, according to the main species landed in the same landing. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Species are sorted by decreasing number of reports.

Main species caught	Species code	Number of reports			LWE		
		absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
Atlantic cod	100	28,017	58.4	58.4	1,448,670	59.2	59.2
Shrimp sp.	702	3,505	7.3	65.7	42,758	1.7	60.9
American plaice	140	3,027	6.3	72.0	190,660	7.8	68.7
Greysole (Witch)	142	2,356	4.9	76.9	84,194	3.4	72.1
Redfish sp.	120	1,658	3.5	80.4	23,532	1.0	73.1
Atlantic halibut	130	1,509	3.1	83.5	58,587	2.4	75.5
Wolffish sp.	174	1,003	2.1	85.6	393,389	16.1	91.5
Greenland halibut	144	808	1.7	87.3	10,339	0.4	92.0
Lumpfish roe	928	712	1.5	88.8	42,993	1.8	93.7
White hake	171	522	1.1	89.9	18,528	0.8	94.5
Winter flounder	143	280	0.6	90.4	27,306	1.1	95.6
Snow crab	705	201	0.4	90.9	1,525	0.1	95.6
Herring	200	80	0.2	91.0	1,586	0.1	95.7
Lumpfish	176	75	0.2	91.2	613	<0.1	95.7
Mackerel	250	61	0.1	91.3	1,638	0.1	95.8
Haddock	110	56	0.1	91.4	2,810	0.1	95.9
Skate	160	47	0.1	91.5	362	<0.1	95.9
Monkfish	177	28	0.1	91.6	4,160	0.2	96.1
Pollock	170	26	0.1	91.6	887	<0.1	96.1
Spiny dogfish	362	22	<0.1	91.7	2,398	0.1	96.2
Lobster	700	15	<0.1	91.7	64	<0.1	96.2
Skate sp.	356	10	<0.1	91.7	1,030	<0.1	96.3
Salmon	354	6	<0.1	91.7	153	<0.1	96.3
Sculpins sp.	181	4	<0.1	91.8	3,936	0.2	96.4
Yellowtail	141	4	<0.1	91.8	23	<0.1	96.5
Mixed roes	922	3	<0.1	91.8	777	<0.1	96.5
Dogfish	161	3	<0.1	91.8	8	<0.1	96.5
Cusk	173	1	<0.1	91.8	49	<0.1	96.5
Rock cod	101	1	<0.1	91.8	7	<0.1	96.5
Rock eel/Snake blenny	186	1	<0.1	91.8	7	<0.1	96.5
Shad	355	1	<0.1	91.8	7	<0.1	96.5
Silver hake	172	1	<0.1	91.8	1	<0.1	96.5
Sand eel	178	1	<0.1	91.8	1	<0.1	96.5
Chimaera	184	1	<0.1	91.8	1	<0.1	96.5
Roundnose grenadier	179	1	<0.1	91.8	0	0.0	96.5
Unspecified flounders	149	15	<0.1	91.8	114	<0.1	96.5
Unspecified groundfish	199	1	<0.1	91.8	1	<0.1	96.5
Unspecified		3,921	8.2	100.0	85,967	3.5	100.0
Total		47,983	100.0		2,449,081	100.0	

Table 12. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, according to the main species landed in the same landing. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Species are sorted by decreasing LWE.

Main species caught	Species code	Number of reports			LWE		
		absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
Atlantic cod	100	28,017	58.4	58.4	1,448,670	59.2	59.2
Wolffish sp.	174	1,003	2.1	60.5	393,389	16.1	75.2
American plaice	140	3,027	6.3	66.8	190,660	7.8	83.0
Greysole (Witch)	142	2,356	4.9	71.7	84,194	3.4	86.4
Atlantic halibut	130	1,509	3.1	74.8	58,587	2.4	88.8
Lumpfish roe	928	712	1.5	76.3	42,993	1.8	90.6
Shrimp sp.	702	3,505	7.3	83.6	42,758	1.7	92.3
Winter flounder	143	280	0.6	84.2	27,306	1.1	93.4
Redfish sp.	120	1,658	3.5	87.7	23,532	1.0	94.4
White hake	171	522	1.1	88.8	18,528	0.8	95.2
Greenland halibut	144	808	1.7	90.4	10,339	0.4	95.6
Monkfish	177	28	0.1	90.5	4,160	0.2	95.8
Sculpins sp.	181	4	<0.1	90.5	3,936	0.2	95.9
Haddock	110	56	0.1	90.6	2,810	0.1	96.0
Spiny dogfish	362	22	<0.1	90.7	2,398	0.1	96.1
Mackerel	250	61	0.1	90.8	1,638	0.1	96.2
Herring	200	80	0.2	91.0	1,586	0.1	96.3
Snow crab	705	201	0.4	91.4	1,525	0.1	96.3
Skate sp.	356	10	<0.1	91.4	1,030	<0.1	96.4
Pollock	170	26	0.1	91.5	887	<0.1	96.4
Mixed roes	922	3	<0.1	91.5	777	<0.1	96.4
Lumpfish	176	75	0.2	91.6	613	<0.1	96.5
Skate	160	47	0.1	91.7	362	<0.1	96.5
Salmon	354	6	<0.1	91.7	153	<0.1	96.5
Lobster	700	15	<0.1	91.8	64	<0.1	96.5
Cusk	173	1	<0.1	91.8	49	<0.1	96.5
Yellowtail	141	4	<0.1	91.8	23	<0.1	96.5
Dogfish	161	3	<0.1	91.8	8	<0.1	96.5
Rock cod	101	1	<0.1	91.8	7	<0.1	96.5
Rock eel/Snake blenny	186	1	<0.1	91.8	7	<0.1	96.5
Shad	355	1	<0.1	91.8	7	<0.1	96.5
Silver hake	172	1	<0.1	91.8	1	<0.1	96.5
Sand eel	178	1	<0.1	91.8	1	<0.1	96.5
Chimaera	184	1	<0.1	91.8	1	<0.1	96.5
Roundnose grenadier	179	1	<0.1	91.8	0	0.0	96.5
Unspecified flounders	149	15	<0.1	91.8	114	<0.1	96.5
Unspecified groundfish	199	1	<0.1	91.8	1	<0.1	96.5
Unspecified		3,921	8.2	100.0	85,967	3.5	100.0
Total		47,983	100.0		2,449,081	100.0	

Table 13. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, by NAFO sub-division. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Sub-divisions are sorted by decreasing number of reports.

Zone	Number of reports			LWE		
	absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
4Rb	16,944	36.4	36.4	716,047	29.9	29.9
4Rd	11,293	24.2	60.6	502,422	21.0	50.9
4Rc	5,811	12.5	73.1	563,911	23.5	74.4
4Ra	3,927	8.4	81.5	153,994	6.4	80.8
4Tf	2,488	5.3	86.9	41,361	1.7	82.6
4Sv	1,424	3.1	89.9	188,358	7.9	90.4
4Tg	988	2.1	92.1	24,097	1.0	91.4
4Tn	954	2.0	94.1	50,822	2.1	93.5
4To	631	1.4	95.5	11,017	0.5	94.0
4Sx	627	1.3	96.8	61,454	2.6	96.6
4Ss	498	1.1	97.9	11,081	0.5	97.0
4Si	319	0.7	98.6	18,021	0.8	97.8
4Sy	193	0.4	99.0	37,167	1.6	99.3
4Tk	188	0.4	99.4	9,999	0.4	99.8
4Tl	172	0.4	99.7	774	0.0	99.8
4Sw	47	0.1	99.8	3,675	0.2	99.9
4Sz	34	0.1	99.9	576	<0.1	100.0
4Tq	20	<0.1	100.0	380	<0.1	100.0
4Tm	8	<0.1	100.0	168	<0.1	100.0
4Tj	4	<0.1	100.0	31	<0.1	100.0
4Tp	3	<0.1	100.0	18	<0.1	100.0
4Th	1	<0.1	100.0	366	<0.1	100.0
Total	46,574	100.0		2,395,739	100.0	

Table 14. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, by NAFO sub-division. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Sub-divisions are sorted by decreasing LWE.

Zone	Number of reports			LWE		
	absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
4Rb	16,944	36.4	36.4	716,047	29.9	29.9
4Rc	5,811	12.5	48.9	563,911	23.5	53.4
4Rd	11,293	24.2	73.1	502,422	21.0	74.4
4Sv	1,424	3.1	76.2	188,358	7.9	82.3
4Ra	3,927	8.4	84.6	153,994	6.4	88.7
4Sx	627	1.3	85.9	61,454	2.6	91.3
4Tn	954	2.0	88.0	50,822	2.1	93.4
4Tf	2,488	5.3	93.3	41,361	1.7	95.1
4Sy	193	0.4	93.7	37,167	1.6	96.7
4Tg	988	2.1	95.9	24,097	1.0	97.7
4Si	319	0.7	96.6	18,021	0.8	98.4
4Ss	498	1.1	97.6	11,081	0.5	98.9
4To	631	1.4	99.0	11,017	0.5	99.3
4Tk	188	0.4	99.4	9,999	0.4	99.8
4Sw	47	0.1	99.5	3,675	0.2	99.9
4Tl	172	0.4	99.8	774	<0.1	99.9
4Sz	34	0.1	99.9	576	<0.1	100.0
4Tq	20	<0.1	100.0	380	<0.1	100.0
4Th	1	<0.1	100.0	366	<0.1	100.0
4Tm	8	<0.1	100.0	168	<0.1	100.0
4Tj	4	<0.1	100.0	31	<0.1	100.0
4Tp	3	<0.1	100.0	18	<0.1	100.0
Total	46,574	100.0		2,395,739	100.0	

Table 15. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, according to province. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Provinces are sorted by decreasing LWE.

Province	n reports		LWE	
	absolute	rel. %	absolute	rel. %
NF	37,282	77.7	1,872,467	76.5
QC	5,324	11.1	471,721	19.3
NS	4,959	10.3	83,715	3.4
NB	215	0.4	19,505	0.8
PEI	203	0.4	1,673	0.1
Total	47,983	100.0	2,449,081	100.0

Table 16. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, according to the port of landing. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Ports are sorted by decreasing number of reports. Category "Other" pools the ports that collectively contributed 10% of the total number of reports.

Locality	Prov.	code	n reports			LWE		
			absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
PORT AU CHOIX	NF	54801	6,992	14.6	14.6	350,877	14.3	14.3
PORT SAUNDERS	NF	54705	5,721	11.9	26.5	98,093	4.0	18.3
CODROY	NF	54002	5,126	10.7	37.2	233,884	9.5	27.9
TROUT RIVER	NF	54501	2,187	4.6	41.7	139,181	5.7	33.6
BAY ST. LAWRENCE	NS	10102	1,806	3.8	45.5	26,908	1.1	34.7
MARGAREE	NF	53905	1,646	3.4	48.9	68,571	2.8	37.5
COW HEAD	NF	54604	1,533	3.2	52.1	108,605	4.4	41.9
RIVIERE-AU-RENARD	QC	40802	1,484	3.1	55.2	165,747	6.8	48.7
THREE ROCK COVE	NF	54202	1,222	2.5	57.8	123,254	5.0	53.7
GRANDE-RIVIERE	QC	41102	1,200	2.5	60.3	132,525	5.4	59.1
ROCKY HARBOUR	NF	54505	1,062	2.2	62.5	29,288	1.2	60.3
CLORIDORME	QC	40627	874	1.8	64.3	78,225	3.2	63.5
LUNENBURG	NS	12601	866	1.8	66.1	2,001	0.1	63.6
LITTLE PORT	NF	54407	828	1.7	67.8	118,845	4.9	68.4
LOURDES	NF	54204	806	1.7	69.5	68,100	2.8	71.2
MAINLAND	NF	54201	732	1.5	71.0	92,891	3.8	75.0
PARSON'S POND	NF	54606	721	1.5	72.5	19,829	0.8	75.8
CHANNEL PORT AUX BASQUES	NF	53906	690	1.4	74.0	76,568	3.1	78.9
DANIEL'S HARBOUR	NF	54608	655	1.4	75.3	25,699	1.0	80.0
BLACK DUCK BROOK	NF	54302	642	1.3	76.7	31,302	1.3	81.3
CRABBS RIVER	NF	54005	566	1.2	77.9	13,358	0.5	81.8
SAINTE-THERESE	QC	41011	561	1.2	79.0	60,333	2.5	84.3
CHETICAMP	NS	10201	503	1.0	80.1	10,312	0.4	84.7
RIVER OF PONDS	NF	54702	490	1.0	81.1	3,485	0.1	84.8
RED BROOK	NF	54115	450	0.9	82.0	28,795	1.2	86.0
GLACE BAY	NS	10701	437	0.9	82.9	5,453	0.2	86.2
BURNT ISLANDS	NF	53902	354	0.7	83.7	20,424	0.8	87.1
PETITE ILE WHALE HEAD	QC	42206	333	0.7	84.4	11,955	0.5	87.6
EDDIES COVE WEST	NF	54802	321	0.7	85.0	1,486	0.1	87.6
WOODY POINT	NF	54502	291	0.6	85.7	10,084	0.4	88.0
THREE MILE ROCK	NF	54605	279	0.6	86.2	16,992	0.7	88.7
DEGRAS	NF	54114	257	0.5	86.8	6,952	0.3	89.0
LONG POINT	NF	54301	255	0.5	87.3	8,422	0.3	89.4
SHEAVES COVE	NF	54112	243	0.5	87.8	10,537	0.4	89.8
LARK HARBOUR	NF	54408	240	0.5	88.3	43,683	1.8	91.6
TOMATOISH	NF	54105	230	0.5	88.8	8,302	0.3	91.9
PETIT DE GRAT	NS	10901	212	0.4	89.2	10,462	0.4	92.3
PLEASANT BAY	NS	10214	209	0.4	89.7	4,146	0.2	92.5
SPIRITY COVE	NF	54703	205	0.4	90.1	1,534	0.1	92.6
Other	-	-	4,754	9.9	100	181,973	7.4	100
Total			47,983	100	100	2,449,081	100	100

Table 17. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, according to the port of landing. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Ports are sorted by decreasing LWE. Category "Other" pools the ports that collectively contributed 10% of total LWE.

Locality	Prov.	code	n			LWE		
			abs.	rel.	rel. cum.	abs.	rel.	rel. cum.
PORT AU CHOIX	NF	54801	6,992	14.6	14.6	350,877	14.3	14.3
CODROY	NF	54002	5,126	10.7	25.3	233,884	9.5	23.9
RIVIERE-AU-RENARD	QC	40802	1,484	3.1	28.3	165,747	6.8	30.6
TROUT RIVER	NF	54501	2,187	4.6	32.9	139,181	5.7	36.3
GRANDE-RIVIERE	QC	41102	1,200	2.5	35.4	132,525	5.4	41.7
THREE ROCK COVE	NF	54202	1,222	2.5	38.0	123,254	5.0	46.8
LITTLE PORT	NF	54407	828	1.7	39.7	118,845	4.9	51.6
COW HEAD	NF	54604	1,533	3.2	42.9	108,605	4.4	56.1
PORT SAUNDERS	NF	54705	5,721	11.9	54.8	98,093	4.0	60.1
MAINLAND	NF	54201	732	1.5	56.3	92,891	3.8	63.9
CLORIDORME	QC	40627	874	1.8	58.1	78,225	3.2	67.1
CHANNEL PORT AUX BASQUES	NF	53906	690	1.4	59.6	76,568	3.1	70.2
MARGAREE	NF	53905	1,646	3.4	63.0	68,571	2.8	73.0
LOURDES	NF	54204	806	1.7	64.7	68,100	2.8	75.8
SAINTE-THERESE	QC	41011	561	1.2	65.9	60,333	2.5	78.2
LARK HARBOUR	NF	54408	240	0.5	66.4	43,683	1.8	80.0
BLACK DUCK BROOK	NF	54302	642	1.3	67.7	31,302	1.3	81.3
ROCKY HARBOUR	NF	54505	1,062	2.2	69.9	29,288	1.2	82.5
RED BROOK	NF	54115	450	0.9	70.9	28,795	1.2	83.7
BAY ST. LAWRENCE	NS	10102	1,806	3.8	74.6	26,908	1.1	84.8
DANIEL'S HARBOUR	NF	54608	655	1.4	76.0	25,699	1.0	85.8
BURNT ISLANDS	NF	53902	354	0.7	76.7	20,424	0.8	86.6
PARSON'S POND	NF	54606	721	1.5	78.2	19,829	0.8	87.4
THREE MILE ROCK	NF	54605	279	0.6	78.8	16,992	0.7	88.1
ROSE BLANCHE	NF	53901	121	0.3	79.1	15,002	0.6	88.8
CRABBS RIVER	NF	54005	566	1.2	80.2	13,358	0.5	89.3
MARCHES POINT	NF	54113	153	0.3	80.6	12,322	0.5	89.8
PETITE ILE WHALE HEAD	QC	42206	333	0.7	81.2	11,955	0.5	90.3
Other	-	-	8,999	18.8	100	237,825	9.7	100
Total			47,983	100	100	2,449,081	100	100

Table 18. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, by fishing gear. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Gears are sorted by decreasing number of reports. NA, not available.

Gear type	Gear code	Number of reports			LWE		
		absolute	rel. %	rel. cum. %	absolute	rel., %	rel. cum. %
Longline	51	17,508	36.5	36.5	1,763,783	72.0	72.0
Gillnet (set or fixed)	41	14,677	30.6	67.1	311,259	12.7	84.7
Bottom otter trawl (stern)	12	6,055	12.6	79.7	144,669	5.9	90.6
Shrimp trawl	19	3,686	7.7	87.4	46,597	1.9	92.5
Danish seine	21	3,667	7.6	95.0	115,135	4.7	97.2
Hand line (baited)	59	681	1.4	96.4	15,120	0.6	97.9
Bottom otter trawl (side)	11	380	0.8	97.2	18,439	0.8	98.6
Jigger	53	354	0.7	98.0	13,257	0.5	99.1
Scottish seine	22	250	0.5	98.5	2,381	0.1	99.2
Pot	62	234	0.5	99.0	2,788	0.1	99.4
Midwater trawl (stern)	15	199	0.4	99.4	2,526	0.1	99.5
Trap net	61	190	0.4	99.8	8,767	0.4	99.8
Other gear	100	51	0.1	99.9	3,371	0.1	100.0
Bottom pair trawl	16	43	0.1	100.0	734	<0.1	100.0
Pair seine	33	3	<0.1	100.0	30	<0.1	100.0
Midwater pair trawl	17	1	<0.1	100.0	4	<0.1	100.0
Gillnet (drift)	42	1	<0.1	100.0	202	<0.1	100.0
Tethered hooks	50	1	<0.1	100.0	16	<0.1	100.0
Other gear	99	1	<0.1	100.0	3	<0.1	100.0
Undetermined	-	1	<0.1	100.0	NA		
Total		47,983	100.0		2,449,081	100.0	

Table 19. Landed catches (LWE, kg) and number of reports of wolffish (Anarhichas sp.) irrespective of the species, by fishing gear. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009. Gears are sorted by decreasing LWE. NA, not available.

Gear type	Gear code	Number of landings			LWE		
		absolute	rel. %	rel. cum. %	absolute	rel. %	rel. cum. %
Longline	51	17,508	36.5	36.5	1,763,783	72.0	72.0
Gillnet (set or fixed)	41	14,677	30.6	67.1	311,259	12.7	84.7
Bottom otter trawl (stern)	12	6,055	12.6	79.7	144,669	5.9	90.6
Danish seine	21	3,667	7.6	87.3	115,135	4.7	95.3
Shrimp trawl	19	3,686	7.7	95.0	46,597	1.9	97.2
Bottom otter trawl (side)	11	380	0.8	95.8	18,439	0.8	98.0
Hand line (baited)	59	681	1.4	97.2	15,120	0.6	98.6
Jigger	53	354	0.7	98.0	13,257	0.5	99.1
Trap net	61	190	0.4	98.4	8,767	0.4	99.5
Other gear	100	51	0.1	98.5	3,371	0.1	99.6
Pot	62	234	0.5	99.0	2,788	0.1	99.8
Midwater trawl (stern)	15	199	0.4	99.4	2,526	0.1	99.9
Scottish seine	22	250	0.5	99.9	2,381	0.1	100.0
Bottom pair trawl	16	43	0.1	100.0	734	<0.1	100.0
Gillnet (drift)	42	1	<0.1	100.0	202	<0.1	100.0
Pair seine	33	3	<0.1	100.0	30	<0.1	100.0
Tethered hooks	50	1	<0.1	100.0	16	<0.1	100.0
Midwater pair trawl	17	1	<0.1	100.0	4	<0.1	100.0
Other gear	99	1	<0.1	100.0	3	<0.1	100.0
Undetermined	-	1	<0.1	100.0	NA		
Total		47,983	100.0		2,449,081	100.0	

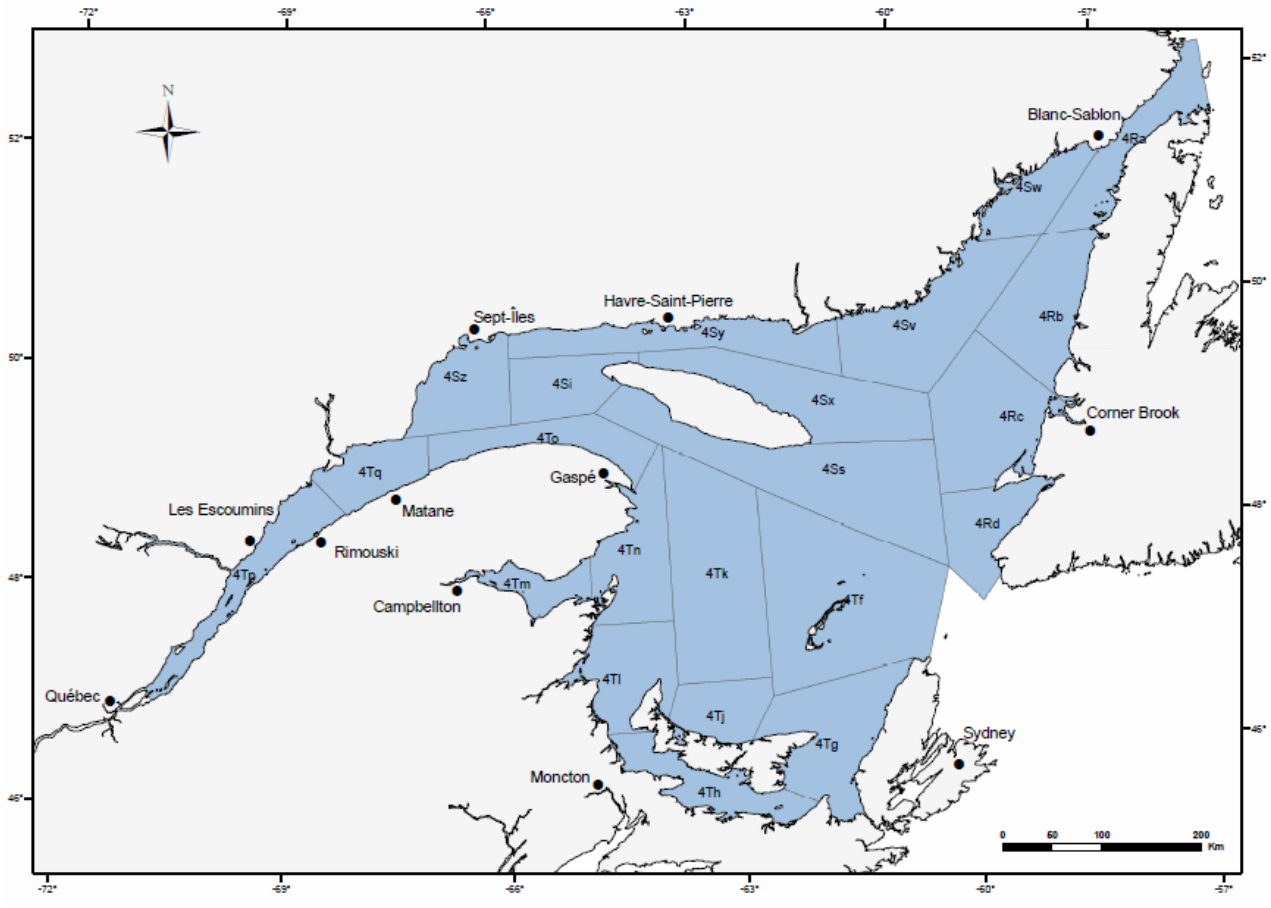

Figure 1. The study area included the St. Lawrence middle and lower estuary as well as the northern and southern Gulf of St. Lawrence. NAFO divisions and sub-divisions for which ZIFF files were compiled are indicated.

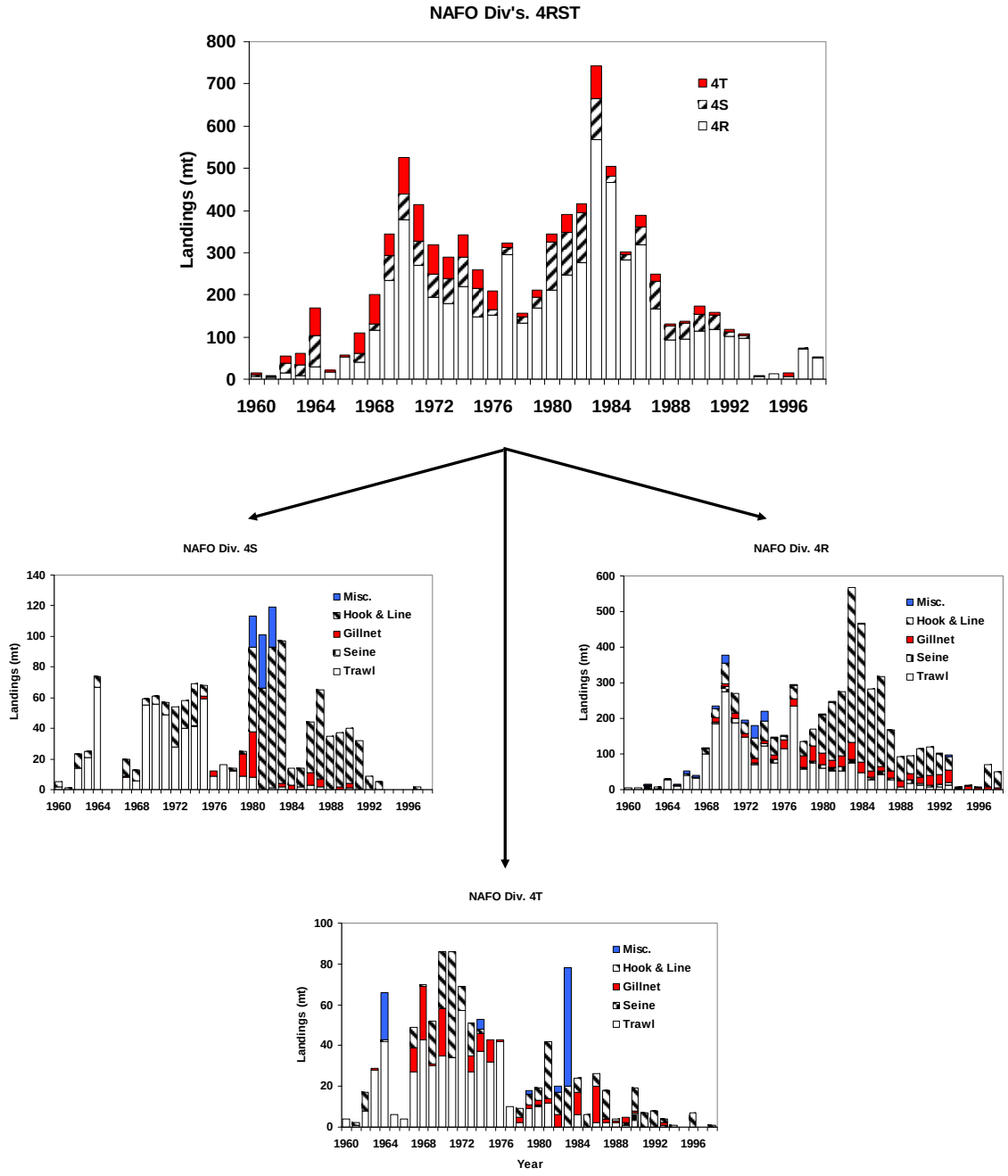

Figure 2. Reported landings (metric tons) of wolffishes (species unspecified, NAFO code 188) in NAFO divisions 4RST (1960–1998) as recorded in NAFO Table 5 landing statistics (upper panel). The three lower panels show the same landings (metric tons) by major gear category in each division.

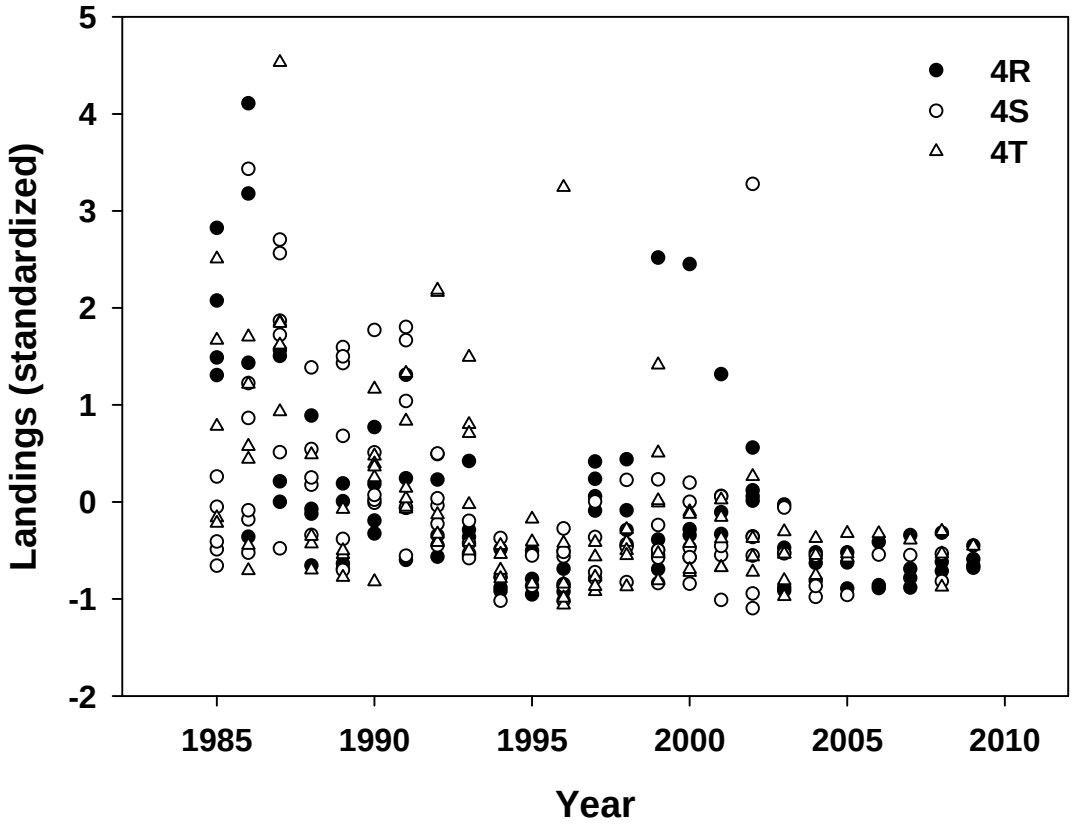

Figure 3. Landed catches (live weight equivalents, kg) of wolffish (Anarhichas sp.) by year and NAFO sub-division (longliners only). Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009 and were standardized by NAFO sub-division. Observations for individual sub-divisions are shown.

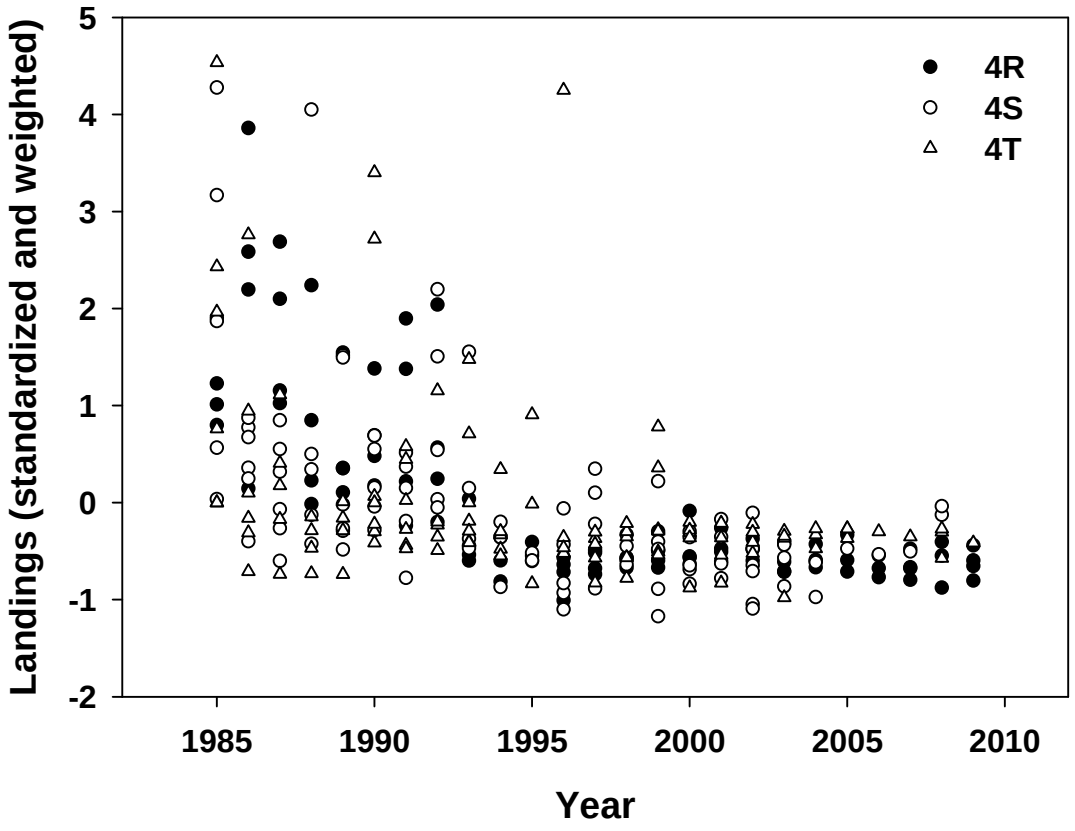

Figure 4. Landed catches (live weight equivalents, kg) of wolffish (Anarhichas sp.) by year and NAFO sub-division (longliners only), weighted by the number of reports. Data are from ZIFF files for the study area (NAFO divisions 4RST) from 1985 to 2009 and were standardized by NAFO sub-division. Observations for individual sub-divisions are shown.

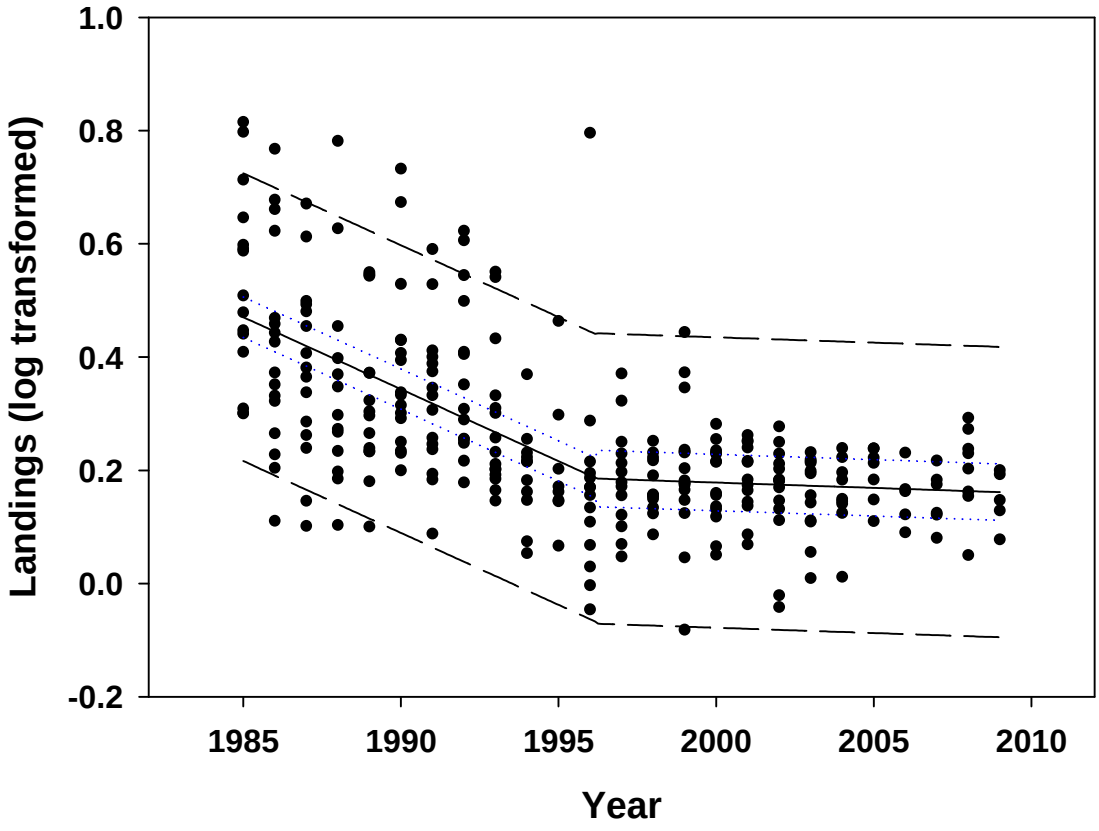

Figure 5. Landed catches (live weight equivalents, kg) of wolffish (Anarhichas sp.) by year and NAFO sub-division (longliners only), weighted by the number of reports, according to ZIFF files for the period from 1985 to 2009. Data were standardized by NAFO sub-division and log-transformed to assess linear regression piecewise. Observations for individual sub-divisions are shown. Solid line, linear regression; dotted line, confidence interval; dashed line, prediction interval.

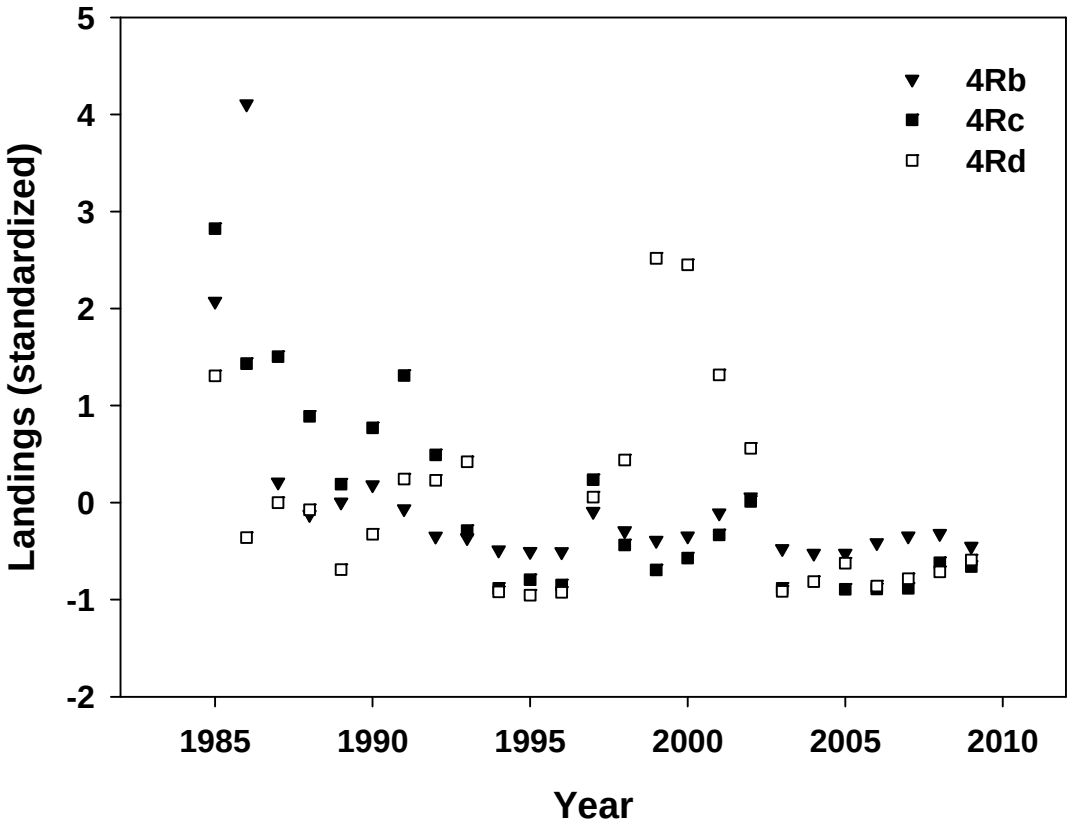

Figure 6. Landed catches (live weight equivalents, kg) of wolffish (Anarhichas sp.) by year (1985–2009) for NAFO sub-divisions 4Rb, 4Rc, and 4Rd (longliners only). Data are from ZIFF files and were standardized by NAFO sub-division. Observations for individual sub-divisions are shown.

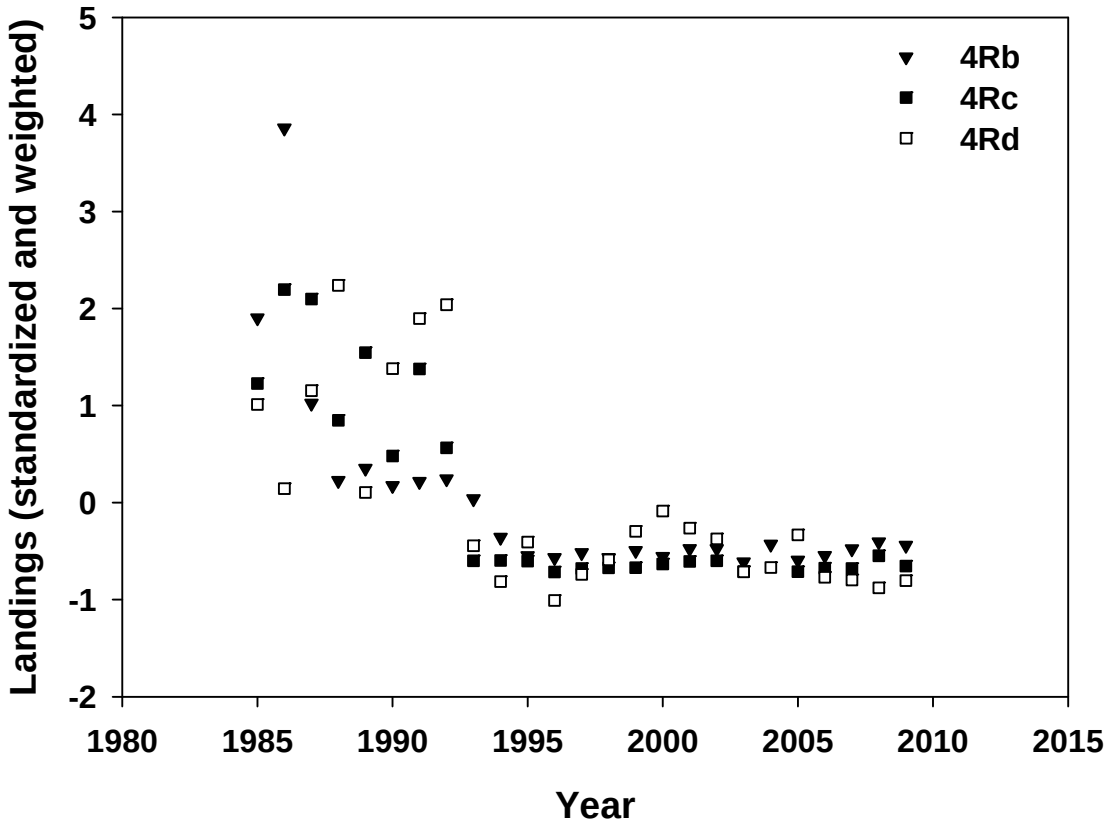

Figure 7. Landed catches (live weight equivalents, kg) of wolffish (Anarhichas sp.) by year (1985–2009) for NAFO sub-divisions 4Rb, 4Rc, and 4Rd (longliners only), weighted by the number of reports. Data are from ZIFF files and were standardized by NAFO sub-division. Observations for individual sub-divisions are shown.

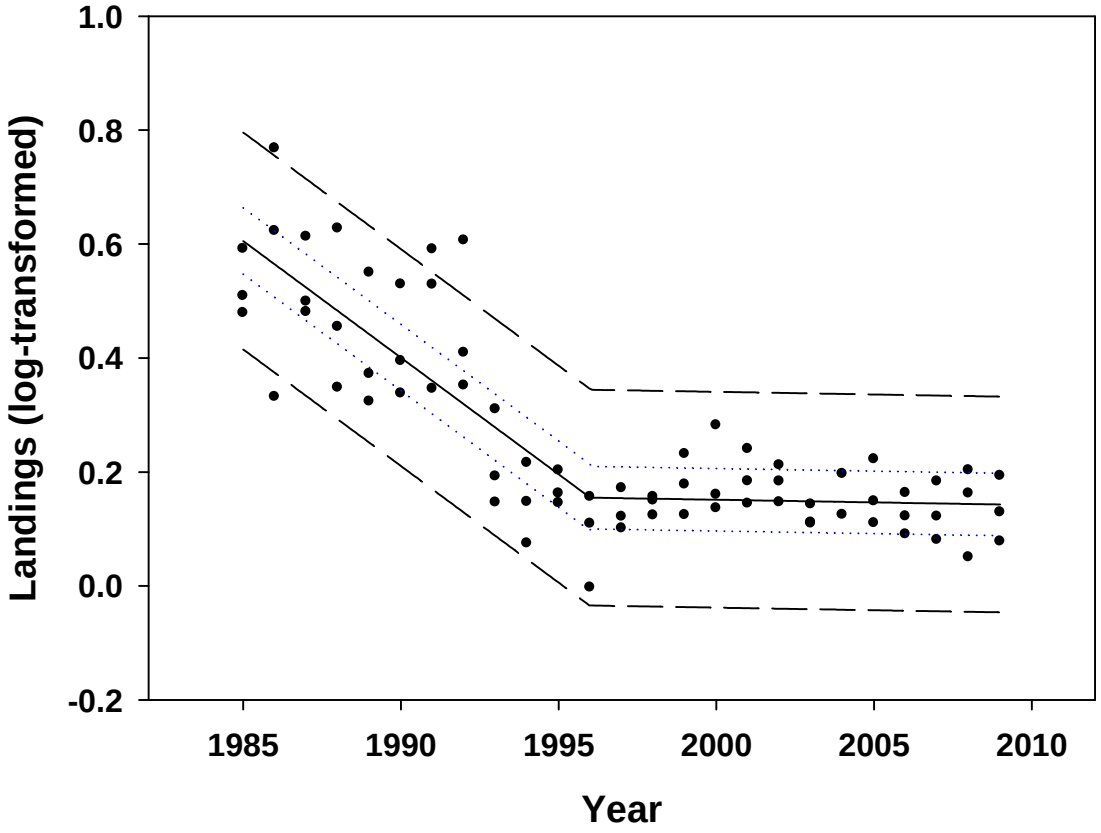

Figure 8. Landed catches (live weight equivalents, kg) of wolffish (Anarhichas sp.) by year for NAFO sub-divisions 4Rb, 4Rc, and 4Rd (longliners only), weighted by the number of reports, according to ZIFF files for the period from 1985 to 2009. Data were standardized by NAFO sub-division and log-transformed to assess linear regression piecewise. Observations for individual sub-divisions are shown. Solid line, linear regression; dotted line, confidence interval; dashed line, prediction interval.

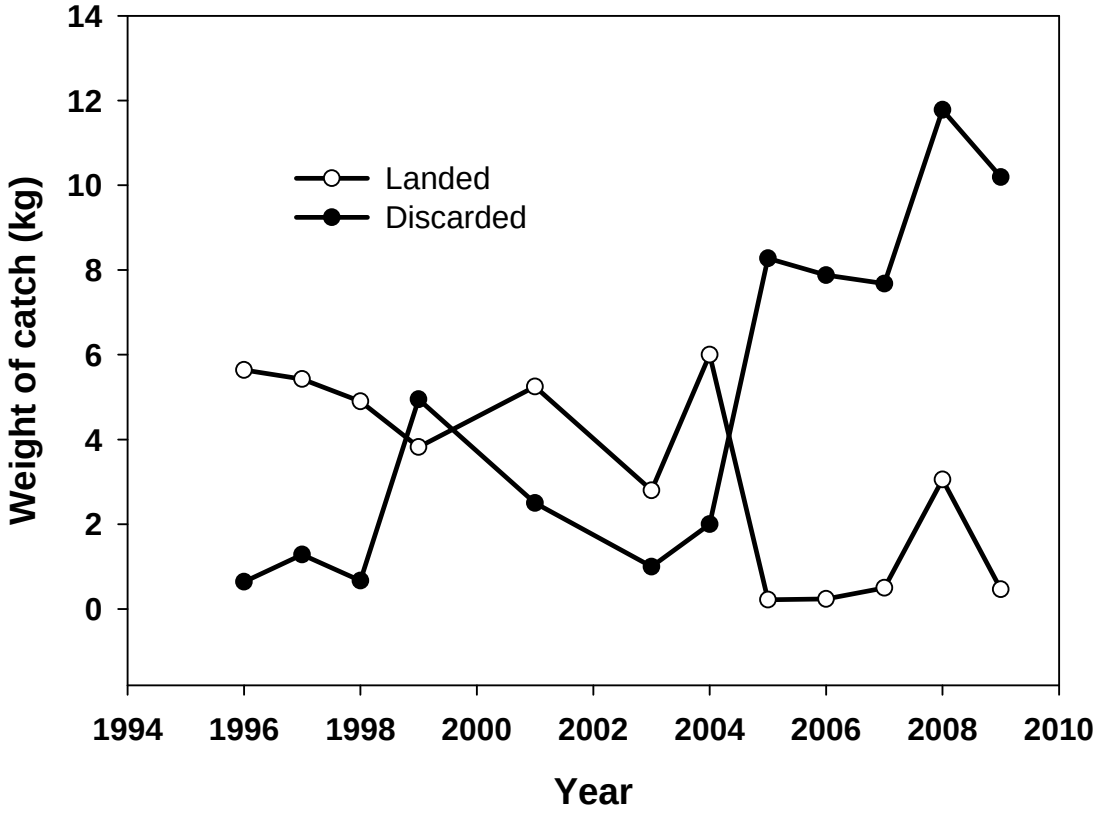

Figure 9. Weights of landings and discards of wolffish (Anarhichas sp.) per set in longline fisheries, based on data from the Observer Program from 1996 to 2009. Observations were made mainly in the northeast portion of the study area, on the west coast of Newfoundland and along the main channels west to Anticosti Island.