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Assessment of wolffish in NAFO subarea 1

by

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Abstract

There are three species of wolffish in Greenland waters, Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*Anarhichas minor*) and Northern wolffish (*Anarhichas denticulatus*). Only the two first are of commercial interest, since northern wolffish is of low quality (gelatines and watery). Although spotted and Atlantic wolffish are easily distinguishable from one another (spotted wolffish has spots, and Atlantic wolffish has stripes), the fishing industry and catch statistics have so far made no distinction between the two species. Thus, a separation of the catch statics on a species level, which is necessary for a detailed biological assessment, may prove difficult, although some observations of the species composition have been made through research work. Commercial fishery targeting wolffish started in the 1928, but significant productions were not seen until after World War II. Initially wolffish were targeted inshore for production of wolffish skin. In 1951 production of frozen filets caught inshore (mainly spotted wolffish) started and reported landings increased to a level of 5000-6000 tons. With the failing cod fishery off West Greenland trawlers started targeting Atlantic wolffish on the banks off West Greenland and from 1974-1976 reported landings from trawlers were around 3000 tons per year. During the 1980's reported catches gradually decreased and landings were at a very low level during the 1990's. However since 2003 landings have gradually increased and stabilized at a level of around 1000 tons, mainly spotted wolffish landed from inshore in division 1A-C. Offshore survey indices for spotted wolffish have increased substantially since 2003 but indices for Atlantic wolffish are only slightly above the 1990's level.

Introduction

Three species of wolffish occur in Greenland waters, Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*Anarhichas minor*) and Northern wolffish (*Anarhichas denticulatus*). Only the two first are of commercial interest, since northern wolffish is of low quality (gelatines and watery). Spotted wolffish has a larger maximum length (~140 cm) than Atlantic wolffish (~ less than 100 cm) and the individual growth rate for Atlantic wolffish is much slower than for Spotted wolffish in subarea 1 (Beese and Känder 1969, Schmidt 1980).

Although spotted and Atlantic wolffish are easily distinguishable from one another (spotted wolffish has spots, and Atlantic wolffish has stripes), the fishing industry and catch statistics have so far made no distinction between the two species. Thus, a separation of the catch statics on a species level, which is necessary for a detailed biological assessment, may prove difficult, although some observations of the species composition have been made through research work. A thorough breakdown of the catches on a species level will however benefit from historical research data from other countries. Research performed by Greenland and Federal Republic of Germany (Beese and Kändler, 1969), revealed an almost complete absence of Atlantic wolffish in landings and research fishery from division 1A and 1B in 1957 and 1960, but a dominance of Atlantic wolffish in division 1C in 1976 (99% by weight, depth 70-90 meters) and 1D in 1980 (58% by weight, depth 300-500 meters) (Schmidt 1980). Therefore, the breakdown of the catches by division gives some indication of species composition as Atlantic wolffish has a more southern distribution and seems more connected to the shallow offshore banks. Spotted wolffish can be found in all divisions offshore and through survey and landing observations, still seems to be the dominant species in the fjords. However Atlantic wolffish has shifted its distribution further north during the past decade (Nygaard and Jørgensen, 2014) and

can be found as far north as the Upernavik district. Atlantic wolffish has also been observed in surveys in the Disko bay (1A inshore) and Sisimiut (1B inshore).

Description of the Fisheries

From 1928, small catches of wolffish from Greenland waters were landed by British fishing vessels. However, the commercial fishery for wolffish in West Greenland started around 1938, and was originally based on the production of wolffish skins, mostly spotted wolffish, while the meat was used for local consumption and food for sledge dogs. Production of skins stopped during World War II, but resumed in 1945 and peaked in 1948 with a production of more than 100.000 wolffish skins equivalent of about 800 tons (table 1, fig 1). In 1951, a production of frozen fillets started and developed to an important production in the Maniitsoq area (div. 1C) and the fishery gradually spread to the northern inshore areas (div 1A-1B). The fishery was carried out by longliners as a directed fishery targeting mainly spotted wolffish. Annual landings reached a level of more than 5000 tons by 1957 and stayed at this level of 4000 to 6000 until 1970. With the failing cod fishery off West Greenland trawlers started targeting Atlantic wolffish on the banks off West Greenland and from 1974-1976 reported landings from trawlers were around 3000 tons per year (Schmidt 1980). The highest reported catches occurred in 1977-1979, but in these years non-Greenlandic vessels were excluded from the valuable cod fishery on the banks off West Greenland and misreporting were documented, where cod were reported as American plaice, wolffish or other species (Horsted 1980). After 1980 the cod fishery gradually decreased from West Greenland and catches of wolffish also decreased in this period. The Gradual switch from cod to shrimp fishery may however have meant that an unknown amount of wolffish could have been taken and discarded in the shrimp fishery. However, a study of by-catch in the shrimp fishery conducted in 1994 indicated a low by-catch of spotted wolffish in all divisions and than by-catch of Atlantic wolffish where low and mainly occurred in the southernmost divisions (Engelstoft 1996). However, survey indices of wolffish were at a low level during the 1990's. To minimize by-catch in the shrimp fishery, offshore shrimp trawlers has been equipped with grid separators since 2002 (G.H. 2001) and the grid separators have also been mandatory for inshore operating vessels since 2011(G.S. 2011). After the implementation of the sorting grids, studies of by-catch in the shrimp fishery indicated very low levels of wolffish in the shrimp fishery when using the grid separators (Sünksen 2007). Sünksen 2007 does not provide length distributions in the publication, but the estimated amounts can be converted to total estimates of wolffish to be around 15 tons of Atlantic wolffish (~0,01%), 1,5 tons of spotted wolffish (~0,001%) and less than 0,2 tons of northern wolffish (~0,0001%) in 2007. In 2007, all survey indices of wolffish were at a higher level than during the 1990's and it seems likely that the grids separators used in the shrimp fishery offer high protection of wolffish. In 2013 only 855 tons of wolffish were reported, of which the majority was caught inshore in divisions 1A-C, indicating that most of the catches were spotted wolffish.

Commercial fishery data

Very little data on length distribution in catches were available.

Survey data

There are two surveys partly covering the stocks of Atlantic wolffish and spotted wolffish in subarea 1. The EU-Germany survey (Fock and Stransky 2014) and Greenland Shrimp Fish survey in West Greenland (Nygaard and Jørgensen 2014). The EU Germany survey has a longer time series (since 1982, 0-400m, 1Bs-F) and the Greenland shrimp and Fish survey in West Greenland covers a larger geographical area (since 1992, 600m, 1A-F). Both surveys are appropriate in regards to main depth distribution of both Atlantic and spotted wolffish.

Assessment results

Due to a lack of adequate commercial data no analytical assessment could be formulated.

Atlantic wolffish:

Biomass indices decreased significant in the 1980s in the EU-Germany survey (Fig. 4). From 2002 to 2005 biomass indices increased in both surveys to above average levels. However after 2005 the biomass returned to the low levels observed during the 1990's. The length distribution has increased slightly in the EU-Germany survey in the most recent years. Abundance indices in the EU-Germany survey decreased after 1982, but were at a stable and perhaps

slightly increasing level until around 2005. After 2005 abundance indices in this survey decreased to below average levels, but remained stable after 2008 (fig 2).

The Greenland shrimp and fish survey biomass indices were at low levels during the 1990's, but slightly increased from 2002 and until the gear change in 2004. After 2005 the biomass seems to have stabilized, but if disregarding outlier years there are indications that the indices continues the increasing trend observed at the end of the previous survey period (1992-2004) (fig 3). Abundance indices in the Greenland shrimp and fish survey also increased from 2002 to 2004. If disregarding the unusually high abundance estimate observed in 2005 the abundance indices seems to have continued the increasing trend of the previous period.

For Atlantic wolffish, the differing trends observed in the EU-Germany survey and the Greenland shrimp and fish survey can largely be explained with the difference in survey area. The increasing trends observed in Greenland shrimp and fish survey biomass indices are observed in divisions 1A-B, and outside the EU-Germany survey area (Fig 3). Therefore, the stagnant indices observed in the EU-Germany survey are likely caused by a change in distribution further north than during the 1990s. Length distributions in the Greenland Shrimp and fish survey consist of all sizes from 5-65 cm with a mode at 10 cm and decreasing numbers with size.

Spotted wolffish:

Biomass indices decreased significant in the 1980s in the EU-Germany survey and were at low levels during the 1990 (fig 4). After 2003 survey biomass indices in this survey increased to around average levels and the 2013 indices are the highest observed since 1982. Abundance indices in the EU-Germany survey gradually decreased from 1982 to 1995 but have gradually increased since then (fig 4). Biomass indices in the Greenland shrimp and fish survey were at low levels during the 1990s but increased in 2002 and 2004. After the gear change in 2005 survey biomass indices have increased substantially and the 2013 estimate is the highest observed (fig 4). Abundance indices of spotted wolffish in the Greenland shrimp and fish survey increased during the 1990s and until the gear change in 2004. After 2005, the abundance indices continued the increase and the 2013 indices are the highest observed. Length measurements from the inshore landings and surveys using longlines indicates that the fishery is currently mostly catching spotted wolffish at lengths between 40 cm and 100 cm with the majority of the catches in the higher end of the interval. Length distributions in the Greenland Shrimp and fish survey consist of all sizes from 5-120 cm with a mode at 10 cm and 100 cm.

References

- Beese G., and Kändler R, 1969. Beiträge zur Biologie der drei nordatlantischen katfischenarten *Anarhichas lupus* L., *A. minor* olafs. Und *A. denticulatus*.- Ber. Deutsch. Wiss. Komm. Meeresforsch, N. F. 20: 21-59
- Schmidt E. 1980. The wolffish fishery at West Greenland. NAFO SCR Doc. 80/VI/77. Ser. No. N130.
- S.A. Horsted, 1980. SCIENTIFIC COUNCIL MEETING - JUNE 1980 Subarea 1 Cod: Data for 1979 and earl 1980, and Estimates of Stock and Yield for 1980-82. NAFO SCR Doc. 80/VI/72 Serial No. N124 (Revised)
- Fock H. and Stransky C.2014. Stock abundance Indices and Length Compositions of Demersal redfish and other finfish in NAFO Sub-area 1 and near bottom water temperatur derived from the EU-Germany bottom trawl survey 1982-2010. NAFO SCR Doc. 14/028, Ser. No. N6324.
- Nygaard R. 2014. Denmark/Greenland Research Report for 2013. NAFO SCS Doc. 14/12, Ser. No. N 1-6307.
- Nygaard R. and Jørgensen O.A. 2014. Biomass and abundance of demersal fish stocks off West Greenland estimated from the Greenland Shrimp-Fish Survey, 1988-2013. NAFO SCR Doc. 14/03, Ser. No. N6293.

Table 1. Catches of wolffish, Atlantic wolffish and spotted wolffish combined in Subarea 1 by NAFO division. (NK indicates subarea 1 -Not Known).

YEAR	1A	1B	1C	1D	1E	1F	NK	Total	NOTE
1945							60	60	1
1946	32,5	16	0,5	1	0	0	0	50	1
1947	375	90	0	0	15	20	0	500	1
1948	576	120	16	8	24	64	155	955	1
1949	632	94	16	0	16	23	324	1104	1
1950	621	73	7	15	15	15	12	742	1
1951	434	149	0	12	6	19	266	886	1
1952	53	380	327	0	0	0	628	1388	1
1953	0	126	1974	0	0	0	634	2734	1
1954	24	0	2410	0	0	0	370	2804	1
1955	35	141	3274	70	0	0	519	4039	1
1956	315	385	2800	35	0	0	1191	4691	1
1957	585	540	3330	45	0	0	1102	5602	1
1958	640	880	2480	0	0	0	879	4879	1
1959	372	806	1922	0	0	0	808	3908	1
1960	304	1164	1528	575	364	468	0	4403	2
1961	382	887	1794	1152	667	678	63	5623	3
1962	254	862	1576	820	850	581	0	4941	3
1963	525	842	1930	1191	907	718	5	6158	4
1964	474	838	1133	870	807	731	25	4878	5
1965	519	1152	2079	968	416	645	0	5779	5
1966	298	1001	1540	955	672	919	6	5391	5
1967	460	1243	1312	1119	483	506	10	5133	5
1968	594	1405	1635	365	176	384	120	4679	5
1969	644	1050	1409	248	92	110	219	3772	6
1970	658	979	765	174	354	173	214	3317	7
1971	525	842	737	181	58	167	522	3032	8
1972	508	894	744	684	346	100	871	4147	8
1973	764	1001	1095	1100	684	235	22	4901	8
1974	516	1203	1424	2156	848	147	0	6290	8
1975	509	1370	1664	2055	545	235	0	6378	8
1976	432	783	1966	1725	855	344	0	6105	8
1977	445	618	1060	416	422	133	(1000)	4110	9
1978	460	753	746	130	72	7	(800)	2970	9
1979	357	515	692	90	43	34	(1400)	3529	10
1980	620	1423	1898	861	275	335	0	5412	11
1981	400	839	1394	308	207	278	291	3717	11
1982	262	636	1539	898	331	263	0	3929	11
1983	145	692	719	475	679	559	0	3269	11
1984	50	231	880	228	268	173	60	1890	11
1985	39	238	933	162	206	226	0	1804	11
1986	80	249	678	204	251	205	30	1697	11
1987	0	0	0	0	17	12	1438	1467	11
1988	68	134	628	261	214	573	111	1989	11
1989	90	91	180	117	309	222	74	1083	11
1990	65	86	116	97	57	182	152	755	11
1991	98	33	84	16	30	79	14	354	11
1992	62	62	44	5	5	12	0	190	11
1993	41	67	33	3	2	11	0	157	11

Table 1 continued. Catches of wolffish, Atlantic wolffish and spotted wolffish combined in Subarea 1 by NAFO division (NK indicates subarea 1 -Not Known).

YEAR	1A	1B	1C	1D	1E	1F	NK	Total	NOTE
1994	26	31	36	0	0	4	0	97	¹¹
1995	19	7	22	0	0	1	0	49	¹¹
1996	29	0	15	0	0	1	0	45	¹¹
1997	30	2	30	0	0	0	0	62	¹¹
1998	0	0	28	0	0	0	0	28	¹¹
1999	1	1	17	87	0	6	0	112	¹¹
2000	0	1	22	5	0	3	21	52	¹¹
2001	1	1	29	4	1	3	26	65	¹¹
2002	14	0	28	8	27	10	0	87	¹¹
2003	142	1	90	2	25	46	0	306	¹¹
2004	205	18	0	35	2	51	0	311	¹¹
2005	161	28	162	47	35	91	0	524	¹¹
2006	267	94	236	26	42	99	0	764	¹¹
2007	425	211	133	32	20	59	0	880	¹¹
2008	600	217	276	37	5	66	0	1201	¹¹
2009							1175	1175	¹²
2010							1315	1315	¹²
2011	365	158	196	13	4	3	42	779	¹³
2012	344	335	292	17	7	15	0	1010	¹⁴
2013	441	175	203	11	7	15	0	855	¹⁴

NOTES

1. After E. Schmidt 1980. Total landings are given by E.Schmidt. Division landings are estimated from division percentage from the Greenlandic fleet only given by E. S. (1946-1959). Landing division by other nations are listed as NK (not known).
2. 116 Tons landed by Icelandic vessels in 1960 (Statlant) does not figure in the statistics by E.S. Division landings are estimated from division percentage (all nations) given by E. Schmidt 1980 and corresponds well with Statlant 21 statistics (years 1960-1976).
3. After E. Schmidt 1980.
4. After E. Schmidt 1980. Estimate of Greenland catch in 1963 is 40 tons higher than Statlant 21 statistics.
5. After E. Schmidt 1980.
6. After E. Schmidt 1980. 13 Tons landed by DDR vessels in 1969 does not figure in the statistics by E.S.
7. After E. Schmidt 1980. 324 Tons landed by DDR vessels in 1970 does not figure in the statistics by E.S.
8. After E. Schmidt 1980.
9. After E. Schmidt 1980. Unreliable statlant 21 catches. See S.A. Horsted 1980, for discussion.
10. After E. Schmidt 1980. Unreliable statlant 21 catches. See S.A. Horsted 1980, for discussion. Estimate of Greenland catch is 398 tons higher in the statistics by E.S. than in Statlant 21 statistics.
11. Based on IGNAF/Statlant 21 data (1980-2008).
12. STACFIS estimate.
13. 42 tons from unknown division by factory vessel receiving catches from small boats.
14. Division recalculated by author.

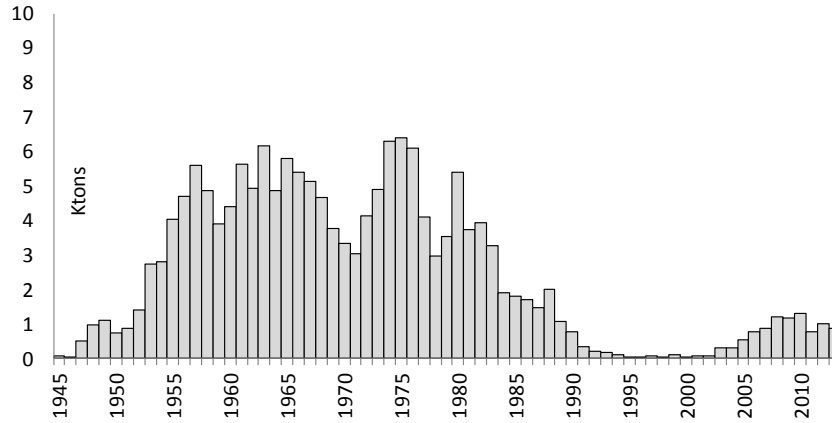


Fig 1. Annual landings of spotted and Atlantic wolffish combined in West Greenland (Subarea 1) by division since 1945.

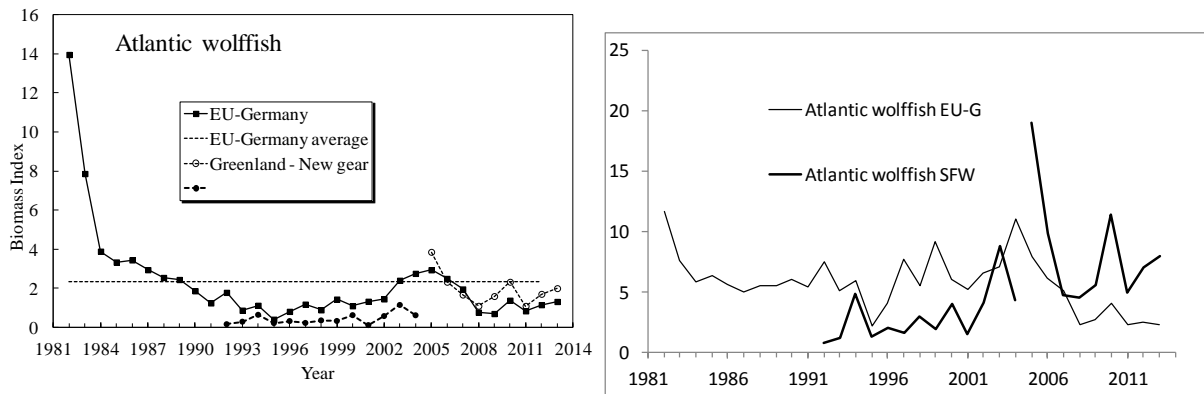


Fig. 2. Atlantic wolffish survey indices of biomass (left) and abundance (right) indices from The EU-Germany survey (EU-G) and the Greenland shrimp and fish survey in West Greenland (SFW).

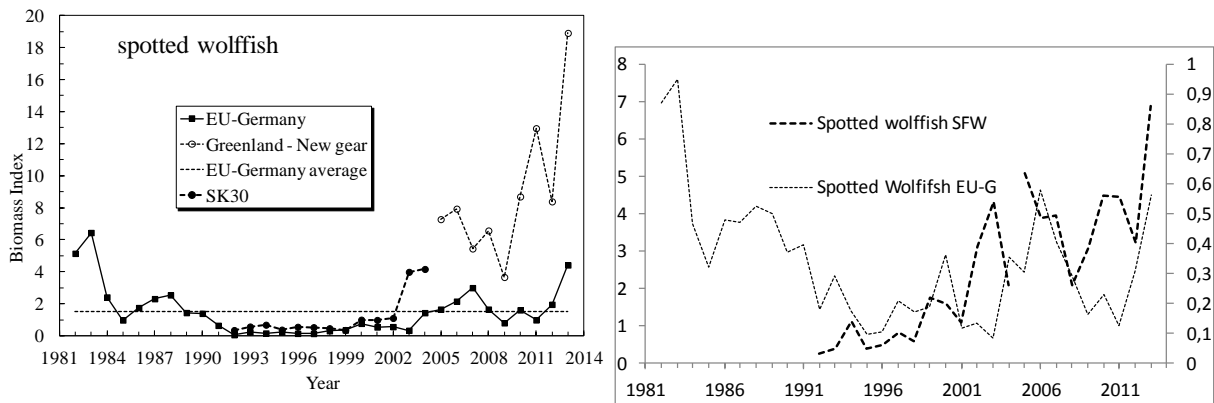


Fig. 3. Atlantic wolffish survey indices of biomass (left) and abundance (right) indices from The EU-Germany survey (EU-G) and the Greenland shrimp and fish survey in West Greenland (SFW). The Gear was changed in the SFW survey in 2005.

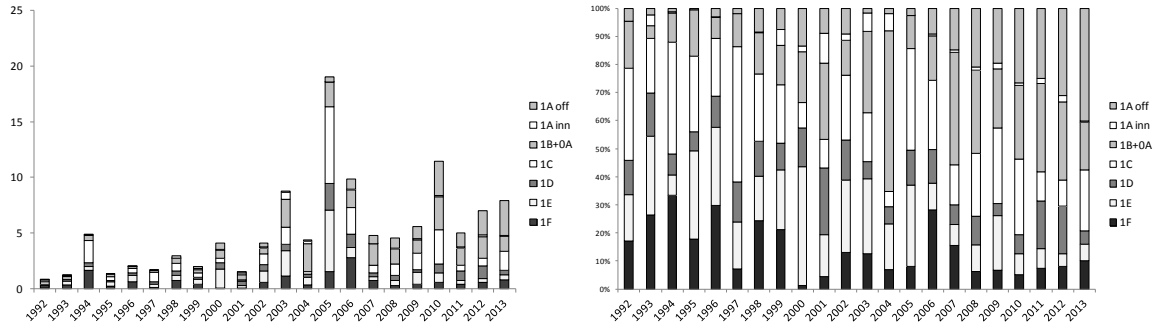


Fig 4. Atlantic wolffish distribution of biomass by division (Percentage left, tons right) in the Greenland shrimp and fish survey (The gear was changed in this survey in 2005). The EU Germany survey covers divisions 1C-F

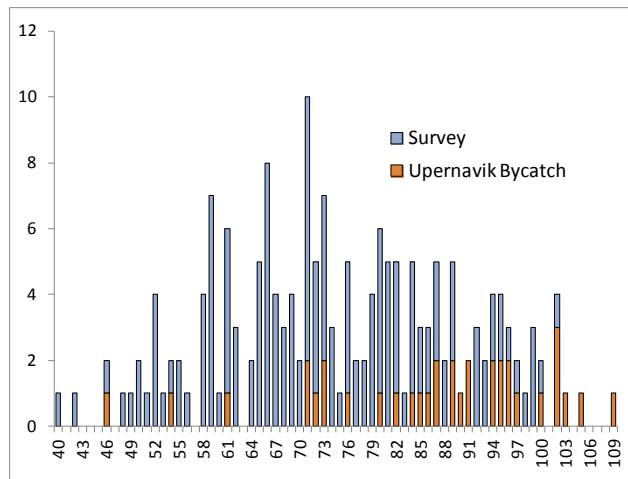


Fig. 5. Length frequencies of Spotted wolffish by-catch in 2014 from the Upernavik area and longline survey catches of spotted wolffish in the Disko bay, Umannaq and Upernavik combined for the years 2010-2013.