OBSERVATION AND INSPECTION DATA: DETERMINING CATCH AND BYCATCH BY FOREIGN FISHERIES ON THE GRAND BANK OUTSIDE THE CANADIAN EEZ

Dave Preikshot

Fisheries Centre, University of British Columbia
2204 Main Mall, Vancouver, BC, V6T 1Z4, Canada

ABSTRACT

The purpose of this project was to assess if the 'Foreign Fisheries Information Service/Canadian Fisheries Information Network' (FFIS/CFIN) databases on foreign fishing vessels in Northwest Atlantic waters, maintained by the Canadian Department of Fisheries and Oceans (DFO), could yield information that might permit the creation of an index of fish extractions from areas outside of the Canadian Exclusive Economic Zone (EEZ) around the Grand Bank. To facilitate this work, staff from DFO (St. John's, Newfoundland) provided consulting services on the history of the fisheries, the purpose and contents of the databases, and the actual exploration of the data itself. FFIS and CFIN are now an integrated database that links information collected by various observation platforms, including the Canadian Coast Guard and DFO Patrols, with Northwest Atlantic Fisheries Organization (NAFO) and Canadian inspections of fishing vessels off Canada's coast. The database contains a large number of variables, not all of which are reported on at all times. The data sets that have been collected for the *Sea Around Us* project are described here. In addition, a method is suggested for linking and integrating the datasets, to allow the building of a new dataset of actual extractions by foreign fishing vessels outside of Canada's territorial waters. This report represents only a preliminary investigation of the use of observation and inspection data.

BACKGROUND

The 'Foreign Fisheries Information Service' (FFIS) was created in the late 1980s as a way for fisheries officers to keep track of vessel sightings and the duration of their stay in Canadian and near Canadian waters of the Northwest Atlantic. Initially, it was an entirely manual system, but was computerized in the early 1990s. Although records for the 1980s have reportedly been entered into the computer database, the records now appear to be lost or are not being made available. DFO staff in Ottawa have made little effort to locate them despite repeated requests from the regional DFO office in St. John's. Therefore, only data from the 1990s were examined in this project. During the 1990s, data collection became more sophisticated. Starting in the early 1990s, the data set included sightings from airplanes and from other vessels, in addition to physical vessel inspections. By the mid 1990s, the data set was again expanded to include 'hails' (required radio contacts) from vessels crossing between NAFO divisions.

The 'Canadian Fisheries Information Network' (CFIN) data set began in the early 1990s, and appears to supercede the pre-existing FFIS data. CFIN is a relational database using ORACLE, providing linkages between data fields to describe boat observations. Because neither CFIN nor FFIS were designed to keep track of fish extractions *per se* the data fields had to be examined individually to see which ones contain useful variables for the *Sea Around Us* project.

DATABASE APPROACHES

An attempt was made to use the database interface to extract data such that an historical record of boats and their activities/catches would be produced. The main difficulty in the creation of a new unified data set was the existence of overlapping records in the CFIN database. For example, if a ship was sighted by a Canadian Coast Guard vessel, and also by a NAFO inspection, both records would appear in the database. However, the inspection data would be more comprehensive, accounting of the boat's activities and its catch. Thus, it is conceivable that for long inspections, there could be many overlapping sightings. In the creation of a unified data set, overlap of information is the first of three problems that had to be addressed. The second problem arose from gaps between sightings. Because there are gaps in the records of sightings, a protocol has to be invoked to decide how big a time gap to allow before a vessel was deemed to have gone to port to unload, or was simply unsighted. The third problem arises from discontinuous variable records, which pervades the whole data base.

Furthermore, in order to create a useful data subset, assumptions have to be applied to the observation and hail data to account, for each vessel, what it was doing and how much it was

catching. These assumptions are based on information on that vessel, or vessel type, derived from the inspection data set. This process required more time that was available for the first phase of the work (Dec. 2000-Feb. 2001). Therefore, *in lieu* of creating a unified data set, the decision was made to extract the data fields most suitable for estimating fisheries extractions and bycatch, for later examination. The data fields chosen from the FFIS/CFIN database were:

1. Inspection logs: an account of what the boat was doing at sea based on log books;
2. Inspection: an account of the vessels inspected in terms of identification and gear;
3. Position: an account of the position of vessels based on observations and hails.

These data tables are described in Appendix 1. A first summary of the catches of groundfish retained versus discarded by foreign vessels between 1990 and 2000, based on the available observation/inspection data is presented in Figure 1, while the overall average discard rates (%) for all species are indicated in Figure 2. Discard estimates are from reports by ships' captains. In order to better calculate extractions from areas beyond Canada's 200 mile EEZ, the following steps are recommended. Calculate trip length, species composition, catches, and discards, for gear types by vessel, by country and by year, using the inspection and inspection log data, then, given this information, generate indices about vessel and gear characteristics to enrich the position data set. The only requirement to do this, is that enough information exists within the position data set to accurately determine when boats were fishing. To do this it will also be necessary to address the time gap issue. For instance, DFO uses the assumption that if a vessel is not sighted for 15 days, then 2.5 days of effort were added to the last recorded time fishing. This problem should not exist for data after the mid 1990s because vessel 'hail' were included.

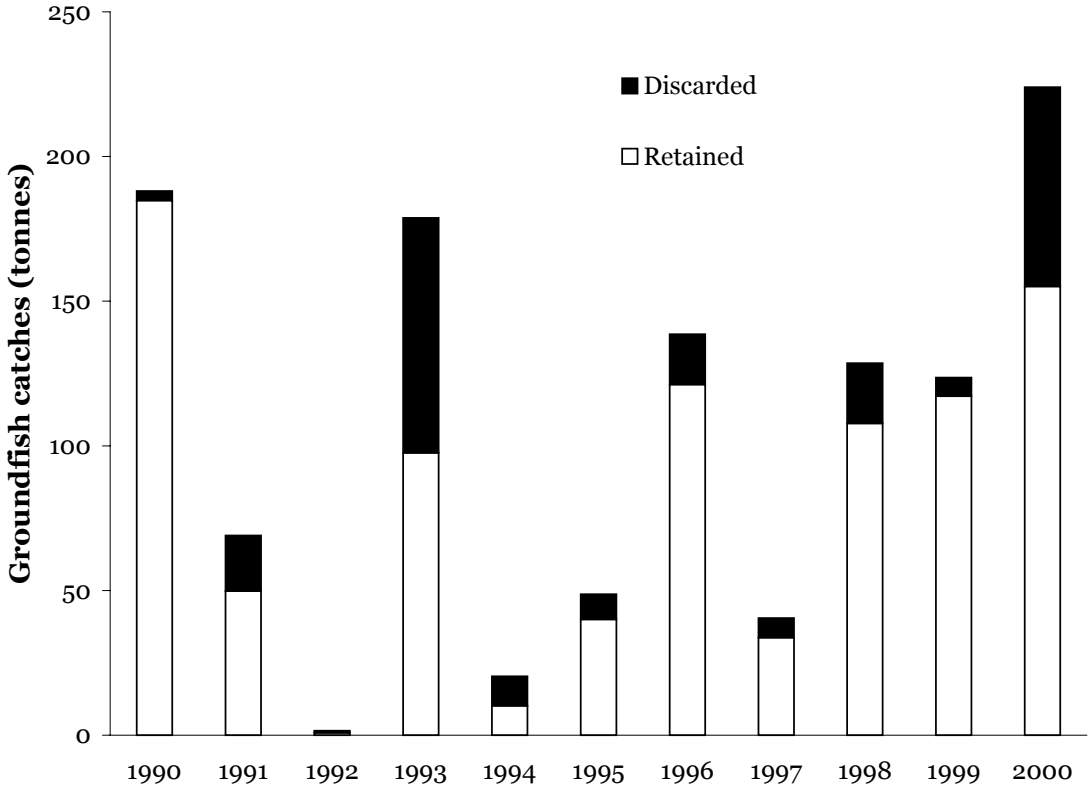

Figure 1. Estimation of catches and discards of groundfish by foreign vessels fishing outside the Canadian 200 nm EEZ between 1990 and 2000, based on the FFIS/CFIN database.

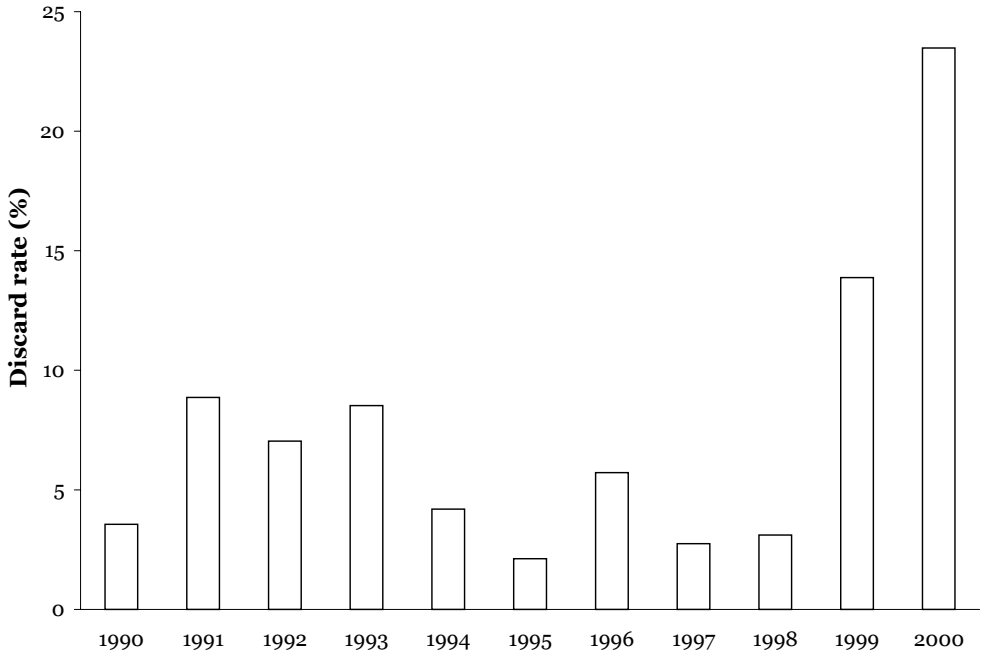

Figure 2. Estimated average discard rates (all species) for foreign vessels fishing in international waters (outside Canada's 200 nm EEZ) between 1990 and 2000, based on FFIS/CFIN data.

The implication is that the position data set will have to be manipulated to transform it into a record of each vessel's activities during the 1990s. This new data set can then be enriched by the inspection log data. It is recommended that the position data be the starting point to which all the other information should be added, to reduce the confounding effect of trying to account for overlapping data. This would require a two-track approach whereby the inspection and inspection log data sets are modified to produce vessel and gear information designed to fit into the position data set. Alternatively, the inspection log data-set provides another choice for acting as a skeleton upon which the information on extractions from the other data sets can be added. However, it might not be as good a choice, since the frequency of inspections has declined somewhat towards the end of the 1990s.

General characteristics of the fishery

The present summary is based on an interview and discussions with Tony Blanchard, a DFO fisheries inspector. The major species targeted in the 1990s is 'turbot', i.e., Greenland halibut (*Reinhardtius hippoglossoides*), which is the only species with a NAFO quota for the area concerned in this project. Grenadiers (*Macrourus berglax* and *Coryphaenoides rupestris*), hake (*Merluccius bilinearis* and *Urophysis chuss*), redfish (*Sebastes* spp.), and skates (*Raja* spp.) are secondary species also caught. Average trip length for EU trawlers is approximately 5 months, whereas shrimp trawlers (nationality not specified) tend to stay out for about 1 month. The average vessel length is 70m, with a crew of 12-24, and a capacity of 400-1,000 t. Boats recorded as 'not fishing' are likely fishing (usually trawling) within 24 hours of the record. Misreporting seems to have declined from the early to mid 1990s but then increased again to the late 1990s . For example, a vessel with a 10 t turbot quota might report a catch of 10 t turbot and 10 t dogfish. Upon inspection it is discovered that there are, in fact, 15 t turbot and 5 t dogfish. Any adjustment protocols that will be applied to create an extraction data set will have to account for these factors and determine their usefulness.

ACKNOWLEDGMENTS

I would like to thank the DFO staff at St. John's, in particular Peter Shelton, Tony Blanchard and Peter Quinlan, for their time and assistance, and the Pew Charitable Trusts, Philadelphia, for funding the *Sea Around Us* project.

APPENDIX 1

Table 1. List of species in the FFIS/CFIN database, provided by Peter Quinlan (DFO, ST. John's). Note that the species codes appear to be similar to those used by NAFO, though they are not the same.

Code	Abbreviation	Description	Scientific Name
100	COD	COD	*Gadus morhua*
101	GRC	ROCK COD	*Gadus ogac*
102	ARC	ARCTIC COD	*Boreogadus saida*
103	LIN	LING COD	*Molva molva*
110	HAD	HADDOCK	*Melanogrammus aeglefinus*
120	RED	REDFISH	*Sebastes* spp.
130	HAL	ATLANTIC HALIBUT	*Hippoglossus hippoglossus*
140	PLA	AMERICAN PLAICE	*Hippoglossoides platessoides*
141	YEL	YELLOWTAIL	*Limanda ferruginea*
142	WIT	WITCH	*Glyptocephalus cynoglossus*
143	FLW	WINTER FLOUNDER	*Pseudopleuronectes americanus*
144	GHL	GREENLAND HALIBUT	*Reinhardtius hippoglossoides*
149	FLX	FLOUNDER	Pleuronectiformes
169	WOL	WOLFISH-UNSPECIFIED	*Anarchichas* spp.
170	POK	POLLOCK	*Pollachius virens*
171	HKW	WHITE HAKE	*Urophysis tenuis*
172	HKS	SILVER HAKE	*Merluccius bilinearis*
173	USK	CUSK	*Brosme brosme*
174	CAT	CATFISH	Siluriformes
175	TOM	TOMCOD	*Microgadus tomcod*
176	LUM	LUMPFISH	*Cyclopterus lumpus*
177	ANG	MONKFISH	*Lophius americanus*
178	SAN	SAND EELS	*Ammodytes* spp.
179	RNG	ROUNDNOSE GRENADIER	*Coryphaenoides rupestris*
180	HKR	RED HAKE	*Urophysis chuss*
181	HKB	BLUE HAKE	*Antimora rostrata*
182	RHG	ROUGHHEAD GRENADIER	*Macrourus berglax*
183	SLA	SANDLANCE	-
184	EEL	EELPOUTS	*Lycodes* spp.
185	WST	WOLFFISH	*Anarchichas spp.*
186	WSP	WOLFFISH	*Anarhichas minor*
187	WNO	WOLFFISH	*Anarhichas lupus*
188	ALF	ALPHONCINOS	*Beryx* spp.
190	GF	GROUNDFISH	-
191	GFL	GROUNDFISH	-
193	GFO	OTHER GROUNDFISH	-
195	GXC	GROUNDFISH	-
197	GRC	GROUNDFISH	-
198	GXA	GROUNDFISH	-
199	GRO	GROUNDFISH-UNSPECIFI	-
200	HER	HERRING	*Clupea harengus*
249	BSF	BLACK SCABBARDFISH	*Aphanopus carbo*
250	MAC	MACKEREL	*Decapterus macarellus*
251	SWO	SWORDFISH	*Xiphia gladius*
252	ALB	TUNA-ALBACORE	*Thunnus alalunga*

Table 1. (continued)

253	BET	TUNA-BIGEYE	*Thunnus obesus*
254	BFT	TUNA, BLUEFIN	*Thunnus thynnus*
255	SKJ	TUNA-SKIPJACK	*Euthynnus alletteratus*
256	YFT	TUNA, YELLOWFIN	*Thunnus albacares*
257	HMK	HORSE MACKEREL	*Trachurus* sp.
259	TUN	TUNA, UNSPECIFIED	Scombridae
260	SAU	BILLFISH	Istiophoridae
287	BUM	BLUE MARLIN	*Makaira nigricans*
289	BAM	BLACK MARLIN	-
299	PEL	PELAGIC FISH	-
350	ALE	ALEWIVES	*Alosa pseudoharengus*
351	ARG	ARGENTINE	*Argentina* spp.
352	ELA	EELS	Notacanthidae
354	SAL	SALMON (ATLANTIC)	*Salmo salar*
355	SHA	SHAD	*Alosa sapidissima*
356	SKA	SKATE	Rajidae
357	SMR	SMELTS	*Osmerus mordax*
358	STB	STRIPED BASS	*Morone saxatilis*
359	STU	STURGEON	Acipenseridae
360	CAP	CAPELIN	*Mallotus villosus*
361	CHR	CHAR	*Salvelinus* spp.
362	DGX	DOGFISH-UNSPECIFIED	*Squalus* sp.
363	TRO	TROUT	Salmonidae
364	SSA	SILVERSIDES	Atherinidae
365	---	SALMON/CHAR	Salmoniformes
369	SPO	SHARK	Lamnidae
370	SGR	SHARK	-
371	SBA	SHARK	-
372	SBL	SHARK	-
376	SHO	SHARK	-
377	SHM	SHARK	-
379	SHX	SHARK	-
399	FIN	OTHER FINFISH	-
600	CLB	BAR CLAMS	-
601	CLS	SOFT SHELL	*Mya arenaria*
602	CLQ	QUAHAUG	*Arctica islandica*
604	CLP	CLAMS-PROPELLER	-
608	CSS	CLAMS-STIMPSON SURF	*Spisula polynyma*
609	CLX	CLAMS	Bivalvia
610	MUS	MUSSELS	*Mytilus* sp.
611	OYA	OYSTERS(AMERICAN)	Ostreidae
612	SCX	SCALLOP	Pectinidae
613	SQU	SQUID	*Loligo* sp.
614	PER	WINKLES	*Busycon* sp.
615	SQI	SQUID-ILLEX	*Illex* sp.
616	SQL	SQUID	*Loligo* sp.
617	WHE	WHELK	-
618	WHB	WHELK	-

Table 1. (continued)

678	OCT	OCTOPUS	-
699	MOL	MOLLUSCS	Bivalvia
700	LBA	LOBSTER	Decapoda
701	BAI	BAIT	-
702	PRA	SHRIMP (PRAWN)	-
703	CRJ	JONAH CRAB	-
704	CRK	ROCK CRABS	-
705	CRQ	SNOW CRABS	Majidae
706	CRR	RED CRABS	-
707	CRA	CRAB	Crustacea
708	KCT	STONE CRAB	-
710	BOR	SHRIMP	*Pandalus* sp.
711	MON	SHRIMP	*Pandalus* sp
712	SHR	SHRIMP	Pandalidae
799	CRU	CRUSTACEANS	Crustacea
800	ROC	ROCK	-
801	BAI	BAIT	-
898	BAI	BAIT (COD)	-
899	BAI	BAIT	-
900	---	DULSE	-
901	---	IRISH MOSS	-
902	---	KELP	-
905	---	OTHER SEAWEEDS	-
909	URC	SEA URCHINS	-
910	WOR	WORMS	Polychaeta
911	---	COD LIVERS	-
912	---	HALIBUT LIVERS	-
913	---	SWORDFISH LIVERS	-
914	---	TUNA LIVERS	-
915	---	PRESERVED COD	-
916	---	SHARK LIVERS	-
919	---	UNSPECIFIED LIVERS	-
920	---	TONGUES	-
921	---	HERRING SCALES	-
922	---	ROES	-
923	---	FISH FINS	-
924	---	LIVER OIL	-
925	---	SHARK FINS	-
926	---	SHARK LIVER	-
927	---	CAVIAR	-
928	---	LUMPFISH ROE	-
930	---	SEAL SKIN,HARP,W.COA	-
931	---	SEAL	-
932	---	SEAL SKIN,HARP,BEATE	-
933	---	SEAL SKIN,HARP,BEDLA	-
934	---	SEAL SKIN,HARP,OLD	-
935	---	SEAL SKIN,HOOD,YOUNG	-
936	---	SEAL SKIN,HOOD,OLD	-
937	---	SEAL SKIN,HOOD,JAR	-

Table 1. (continued)

938	---	SEAL	-
939	---	SEAL OIL	-
940	---	WHALE, FIN	*Balaenoptera physalus*
941	---	WHALE, SEI	*Balaenoptera borealis*
942	---	WHALE, SPERM	*Physeter macrocephalus*
943	---	WHALE, OTHER	Mysticeti
944	---	WHALE, MINKE	*Balaenoptera acutorostrata*
945	---	WHALE, POTHEAD	*Globicephala macrorhynchus*
946	PWS	WHALE, PILOT	*Globicephala melaena*
947	PWL	WHALE, PILOT	*Globicephala melaena*
950	---	SKATE	-
963	---	SEAL, GREY	*Halichoerus grypus*
996	PSH	PURCHASE	-
997	NON	NONE	NULL
998	OTH	OTHER	OTHER
999	UNS	UNSPECIFIED	UNSPECIFIED

Table 2. Gears in the FFIS/CFIN database.

Gear Type	Mobile / Fixed	Description
FDR	F	FIXED DREDGE
FTR	F	FIXED TRAP
FEW	F	FIXED WEIR
FGS	F	FIXED GILLNET (SET)
MLA	M	MOBILE LAMPARA
MPS	M	MOBILE PURSE SEINE
MDS	M	MOBILE DANISH SEINE
RAR	M	ROD AND REEL
CRP	F	CRAB POTS
FLD	F	FIXED LONGLINE (DRIFT)
FSJ	F	FIXED SQUID JIGGER
MBT	M	MOBILE BOTTOM TRAWL
MHS	M	MOBILE HARPOON/SPEAR
MMT	M	MOBILE MIDWATER TRAWL
MPT	M	MOBILE PAIR TRAWL
MTL	M	MOBILE TROLLER LINES
SDM	M	MOBILE SCALLOP DRAG
TLP	M	TENDED LINES (PELAGICS)
FPT	F	FIXED POT
FLS	F	FIXED LONGLINE (SET)
MSS	M	MOBILE SCOTTISH SEINE
FGD	F	FIXED GILLNET (DRIFT)

Table 3. Countries in the FFIS/CFIN database.

Code	Country	NAFO member	EU member
MOR	MOROCCO	N	N
NLD	NETHERLANDS	N	Y
NOR	NORWAY	Y	N
PAN	PANAMA	N	N
PHI	PHILLIPPINES	N	N
POL	POLAND	Y	N
POR	PORTUGAL	Y	Y
ROM	ROMANIA	Y	N
SVI	ST. VINCENT & GRENADINES	N	N
SAF	SOUTH AFRICA	N	N
SPA	SPAIN	Y	Y
SWE	SWEDEN	N	N
UKI	UNITED KINGDOM	Y	Y
USR	USSR	Y	N
VEN	VENEZUELA	N	N
CUB	CUBA	Y	N
CYP	CYPRUS	N	N
FRA	FRANCE	Y	Y
USA	USA	N	N
CAY	CAYMAN ISLAND	N	N
CHI	CHILE	N	N
DEN	DENMARK	Y	Y
EGY	EGYPT	N	N
FAR	FAROE ISLANDS	Y	N
GRE	GREENLAND	Y	N
GDR	GER. DEM. REP.		N
ICE	ICELAND	Y	N
IRE	IRELAND	N	N
JAP	JAPAN	Y	N
KOR	KOREA	Y	N
LIB	LIBERIA	N	N
MEX	MEXICO	N	N
BAH	BAHAMAS	N	N
GER	GERMANY	Y	Y
HON	HONDURAS	N	N
MAL	MALTA	N	N
RUS	RUSSIA	Y	N
LAT	LATVIA	Y	N
EST	ESTONIA	Y	N
LIT	LITHUANIA	Y	N
SIL	SIERRA LEONE	N	N
UKR	UKRAINE	N	N
NZL	NEW ZEALAND	N	N
CAN	CANADA	Y	N
BUL	BULGARIA	Y	N
BEL	BELIZE	N	N
SPM	FRANCE - SPM	Y	N
ITA	ITALY	Y	Y
MAU	MAURITANIA	N	N
ANT	ANTIGUA & BARBUDA	N	N

Table 4. Definitions of key variables in the 'position' table from FFIS/CFIN.

Variable	Definition
VESSEL_ID	Call sign of vessel
LATITUDE	Latitude at time of sighting
LONGITUDE	Longitude at time of sighting
POSITION_DTT	Date-time stamp of vessel sighting
TYPE	**sighting**: vessel seen by observer. **zen:** time of zone entry **msn**: message sent reporting zone entry **zex:** zone exit **msx:** message sent reporting zone exit **pen:** port entry **pex**: port exit
PLATFORM	from which boat was sighted
ACTIVITY_CODE	**1)** fishing **2)** jogging **3)** steaming **4)** fishing-operational **5)** transshipping **6)** in port
DIVISION	NAFO division

Table 5. Definitions of key variables in the 'inspection logs' table from FFIS/CFIN.

Variable	Definition
INSPECT_NO	inspection number
SPECIES	species code
START_DT	date of start of fishing for target species
END_DT	date of end of fishing for target species
DIVISION	NAFO div
TONNAGE	tonnage caught
DISCARDS	Tonnage discarded
DAYS_FISHED	end - start
CATCH_RATE	from log (t/day)

Table 6. Definitions of key variables in the 'inspection' table from FFIS/CFIN.

Variable	Definition
VESSEL_ID	Call sign of vessel
INSPECTION_TYPE	NAFO/Canadian.
PATROL_VESSEL	Patrol vessel name
BOARDING_DTT	Boarding/inspection date-time
GEAR_TYPE	Fishing gear
VIOL_IND	Records of violations
HOLD_MEASURE_IND	Was the hold measured?
DEPART_VESSEL_DTT	Date and time of departure from vessel
COMPLETE_IND	Data entry from inspection complete?
INSP_PORT	Port of inspection
START_DT	Start date of inspection
END_DT	End date of inspection