

2002-2006 Section 35(2) Pacific Region Authorization File Audit Results

D.W. Carter, A.N. Bonamis, S.M. Major, J.F. Gagnon, D.C. Hussey,
and H.A. Pulvermacher

Fisheries and Oceans Canada
Pacific Region
Ecosystem Management Branch
200-401 Burrard Street
Vancouver, British Columbia
V6C 3S4

2012

Canadian Manuscript Report of Fisheries and Aquatic Sciences 3010



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Manuscript reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1-900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 1426 - 1550 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Manuscript Reports. The current series name was changed with report number 1551.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui traitent de problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1 à 900 de cette série ont été publiés à titre de manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

Les rapports manuscrits sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 3010

2012

2002-2006 SECTION 35(2) PACIFIC REGION AUTHORIZATION
FILE AUDIT RESULTS

by

D.W. Carter, A.N. Bonamis, S.M. Major, J.F. Gagnon,
D.C. Hussey, and H.A. Pulvermacher

Fisheries and Oceans Canada
Pacific Region
Ecosystem Management Branch
Suite 200 - 401 Burrard Street
Vancouver, British Columbia
V6C 3S4

© Her Majesty the Queen in right of Canada, 2012,
Cat. No. Fs 97-4/3010E ISSN 0706-6473

Correct citation for this publication:

Carter, D.W., Bonamis, A.N., Major, S.M., Gagnon, J.F., Hussey, D.C., and
Pulvermacher, H.A. 2012. 2002-2006 Section 35(2) Pacific Region
authorization file audit results. Can. Manuscr. Rep. Fish. Aquat. Sci. 3010: iv +
29 p.

TABLE OF CONTENTS

TABLE OF CONTENTS	iii
ABSTRACT	iv
RÉSUMÉ	iv
1.0. INTRODUCTION	1
2.0. METHODS	2
2.1. Data Collection	3
2.2. Data Analysis	4
3.0. RESULTS	4
3.1. File Review	4
3.2. Fish Habitat Affected	6
3.3. HADDs	8
3.4. Compensation	11
3.5. Project monitoring	12
3.6. Financial Securities	14
3.7. Compliance and Effectiveness	15
4.0. DISCUSSION	15
4.1. Record Keeping	15
4.2. Habitat Impacts	16
4.3. Compliance and Effectiveness	19
5.0. CONCLUSIONS	21
6.0. REFERENCES	22
7.0. APPENDICES	23
7.1. Complete File Audit Methodology	23

ABSTRACT

Carter, D.W., Bonamis, A.N., Major, S.M., Gagnon, J.F., Hussey, D.C., and Pulvermacher, H.A. 2012. 2002-2006 Section 35(2) Pacific Region authorization file audit results. Can. Manuscr. Rep. Fish. Aquat. Sci. 3010: iv + 29 p.

Fisheries and Oceans Canada (DFO) conducted a file review of *Fisheries Act* authorizations in British Columbia and the Yukon, similar to a national review conducted by Harper and Quigley (2005). We aimed to determine whether No Net Loss (NNL) of fish habitat was being achieved as outlined in the *Habitat Policy* (1986). We found the total area of habitat impacted exceeded the total area of compensation habitat. In-channel and riparian habitats were the most frequently affected habitat types. Industrial development, mining and transportation activities resulted in the largest proposed areal impacts, and on average critical and important habitats appeared to be affected more than marginal habitats. Our finding that 50% of projects achieved NNL is similar to that of Quigley and Harper (2005), suggesting that DFO still needs to improve its record-keeping, address proponent non-compliance and incorporate science-based monitoring to better achieve NNL.

RÉSUMÉ

Carter, D.W., Bonamis, A.N., Major, S.M., Gagnon, J.F., Hussey, D.C., and Pulvermacher, H.A. 2012. 2002-2006 Section 35(2) Pacific Region authorization file audit results. Can. Manuscr. Rep. Fish. Aquat. Sci. 3010: iv + 29 p.

Pêches et Océans Canada (MPO) a mené une étude des dossiers relatifs aux autorisations accordées en Colombie-Britannique et au Yukon en vertu de la *Loi sur les pêches*, semblable à l'étude nationale effectuée par Harper et Quigley (2005). Nous avons ainsi tenté de déterminer si l'objectif « aucune perte nette » avait été atteint pour l'habitat du poisson, comme le souligne la *politique sur l'habitat* (1986). Nous avons découvert que l'aire totale de l'habitat touché dépassait l'aire totale de l'habitat de compensation. Les habitats riverains et ceux situés dans les chenaux sont les habitats les plus souvent touchés. Les activités liées à l'industrialisation, à l'exploitation minière et au transport ont été les plus nocives et, en général, les habitats essentiels et importants semblent avoir été plus touchés que les habitats marginaux. Notre conclusion selon laquelle l'objectif « aucune perte nette » a été atteint dans la moitié des projets correspond à celle de Quigley et Harper (2005), ce qui laisse entendre que le MPO doit améliorer davantage sa tenue de dossiers, remédier à la non-conformité des promoteurs et incorporer une surveillance axée sur les sciences pour atteindre l'objectif « aucune perte nette » dans une plus grande mesure.

1.0. INTRODUCTION

The habitat provisions of the *Fisheries Act* provide the legal framework for regulating impacts on fish and fish habitat associated with works and activities occurring in or around fresh and marine waters throughout Canada. In 1986, Fisheries and Oceans Canada (DFO) implemented the *Policy for the Management of Fish Habitat* (the Habitat Policy; DFO 1986), which provides a comprehensive framework for the administration and enforcement of habitat protection provisions of the *Fisheries Act*. The guiding principle of the *Habitat Policy* is No Net Loss (NNL), and the long term objective is to achieve an overall net gain of the productive capacity of fish habitats. The productive capacity of habitats is the maximum natural capability of habitats to produce healthy fish, and the aquatic organisms upon which fish rely for food (DFO 1998). Three goals were established as a means of increasing the natural productive capacity of fish habitat: 1) conserving the existing productive capacity of fish habitats; 2) restoring damaged fish habitats; and 3) creating new fish habitats (DFO, 1986). DFO applies the principle of NNL when it authorizes the harmful alteration, disruption or destruction (HADD) of fish habitat under Section 35 (2) of the *Fisheries Act*. Authorized unavoidable habitat losses as a result of development are offset by requiring proponents to provide habitat compensation in order to maintain the productive capacity of Canada's fisheries.

To assess the performance of compensation projects in achieving NNL Harper and Quigley (2005b) performed a national review of files relating to *Fisheries Act* Section 35 (2) authorizations issued across Canada between 1994 and 1997. They examined what types of HADDs were authorized, the habitat types that were affected, and the types of habitat management approaches that were being used to compensate for HADDs and monitor and ensure success of Compensation. Their key objectives were to assess proponent compliance, the effectiveness of habitat compensation, and the achievement of NNL. We attempted to replicate their work, to specifically assess Pacific Region's Habitat Management Program (HMP) performance in meeting these objectives and to establish a baseline for Pacific Region that can be used to evaluate current and future program and policy initiatives.

The information categories identified by Harper and Quigley (2005b) were audited for authorizations issued in the calendar years 2002 to 2006, inclusive. The audit assessed: information completeness, information quality, method of information recording/storage, and ease of information access. Information to support analysis of the HMP's delivery of the NNL objective was also collected, including area and type of habitat impacted, area and type of compensation works completed, and compensation monitoring efforts. While this audit did not involve ground-truthing the information found in the files may form part of the foundation for a future field audits by serving as a valuable tool for examining the performance of Pacific Region HMP in ensuring proponent compliance and achieving NNL.

2.0. METHODS

Authorizations issued under Section 35(2) of the *Fisheries Act* in DFO's Pacific Region between 2002 and 2006 were collected and reviewed. Files were gathered from the five Areas within the Pacific Region: BC Interior (North and South), North Coast, South Coast, Lower Fraser, and Yukon-Transboundary Rivers (Fig. 1). Large-scale development projects formally classified as Major Projects were grouped separately due to their size and scope. These projects were issued authorizations through the Environmental Assessment and Major Project (EAMP) group within the Habitat Management Program, and are located among Areas in the Pacific Region. Treated as a distinct group, Major Projects provide an overview of EAMP authorization practices across the Pacific Region.



Figure 1: Habitat Management Areas in the Pacific Region, including BC Interior (North and South), North Coast, South Coast, Lower Fraser, and the Yukon-Transboundary Rivers Area.

2.1. Data Collection

The authorization files included in the sample population were issued in the calendar years 2002 to 2006 inclusive. To be included in the audit, the activities within the authorization (specifically, the HADD) must have occurred, and compensation works associated with the authorization were to be due for completion during the audit period. In addition, one full year of post-construction monitoring on the compensatory works was to have been completed for the project. Anomalous files such as research and restoration files authorized during the 2002-2006 period were audited but ultimately removed from the data set because these files were not comparable with other files. A lack of uniformity in authorizing restoration-related projects was noted; some restoration projects were issued *Fisheries Act* Section 35(2) authorizations, while others were not. Research projects were excluded because the intensive assessments involved in these projects were not undertaken on the grounds of risk (e.g. type of project activity, habitat quality, or species present), but rather because the intrinsic reason for the project was research. Files were included in the audit as long as the authorization was available and all other inclusion criteria were met, even if some non-essential components of the files were missing.

Project files were collected digitally or in hardcopy for auditing. In addition to the authorization, the following key file components were used to audit the files: project proposal or site plan; impact assessments (pre/post construction); biophysical site assessment; *Canadian Environmental Assessment Act* (CEAA) screening report; site visit documentation; compensation and monitoring cost estimates; letters-of-credit; monitoring reports; HADD and compensation as-built drawings; documents pertaining to any compliance issues; and documents relevant to the compensation being deemed “functioning as intended.”

The files were audited as per the methodology outlined and defined in Harper and Quigley (2005b). Key deviations from their methodology are noted in square brackets. Project Information (project name, water body, proponent, DFO contact, whether location was recorded, and location type if recorded); HADD Information (PATH Number, land use associated with the project, development activity classification, a description of the HADD, habitat value of affected area, the justification of the HADD, compensation option selected); Habitat Information (habitat type [simplified from Harper and Quigley 2005b]), habitat usage, species present, HADD area, compensation area, habitat type, and compensation technique employed); Cost and Financial Information (cost of compensatory work, cost of monitoring, amount and duration of financial security); Proponent Monitoring Information (pre- and post-construction assessment class, post-construction monitoring frequency, compensation performance criteria, compensation contingency measures); and DFO Monitoring Information (compliance site visit details, mitigation compliance, project and compensatory work as-built diagrams, compensation compliance, proponent monitoring criteria, monitoring report status) were compiled and examined in this audit.

File information and management, file accessibility, and file status were also compiled for this audit. The file management and accessibility data identified the location and

information available in hard copy, Program Activity Tracking for Habitat (PATH), and/or electronic file. The file status data detailed each PATH record (including the Action Log entries), Letter-of-Credit location and status, and monitoring report receipt and status. Data were compiled in a MS Access database during the audit and exported into MS Excel for analysis.

2.2. Data Analysis

For each authorization, the total HADD area and compensation area within each Area in the Region was calculated. In some cases it was not possible to obtain areal measurements for both the HADD and Compensation elements, therefore, only a subset of files were examined, where only habitat subcomponents with areal measures for both elements were included. The information collected from this subset of files was used to generate an overall balance of the reported HADD and Compensation areas for each habitat type.

Summary statistics (mean and standard error) were used to describe variables of interest (e.g. mean HADD footprint by habitat value). Chi-square tests were used to test for differences in frequency of HADDs among habitat categories, land use activities, pre- and post-impact assessment categories, and between selected compensation options from DFO's hierarchy of preferences for compensation projects (DFO 2002). Chi-square tests were also used to determine if there was a relationship between the retention of financial security and compensation compliance, achievement of NNL and monitoring compliance.

ANOVAs (analysis of variance) were used to test for differences between mean HADD and mean Compensation areas by land-use activity. ANOVAs were also used to test if the mean ratio of Compensation differed by habitat value, and if mean monitoring duration differed by habitat value. The relationship between HADD and Compensation areas was examined using linear regression. These two variables were log transformed to stabilize variability in the residuals and satisfy the assumption of normality. Statistical significance for all tests was assessed at $\alpha < 0.05$. MS Excel 2010 was used to tabulate the data and summarize descriptive statistics. Chi-square tests, ANOVA's and other statistical analyses were performed using the R Statistical Computing application, Release 2.15 (R Development Core Team 2012).

3.0. RESULTS

3.1. File Review

A total of 240 authorization files were collected and reviewed from the five Areas in Pacific Region (BC Interior, North Coast, South Coast, Lower Fraser, and Yukon Transboundary Rivers). All authorization files relating to Environmental Assessments and Major Projects (EAMPs) were grouped separately (Table 1). File quality was variable and ranged from complete up-to-date files, to files that were missing file components, monitoring reports, or other information considered in this review. The

number of authorization files reviewed from 2002-2006, along with the number of authorized HADD and compensation sites, and their total HADD and compensation footprints (m²) are detailed in Table 1. The 240 authorization files reviewed, included a total of 347 corresponding HADD and compensation sites, however, only 284 of the HADD sites and 247 of the compensation sites had quantified footprint measurements (m²).

Table 1: The total number of Section 35(2) authorizations (2002-2006) and total measureable HADD (n = 284 sites) and Compensation area (n = 247), by Area in the Pacific Region. HADDs were classified by habitat type, therefore, files with multiple habitat types typically included multiple HADD and Compensation sites.

Regional Area	Number of Authorization Files	Number of HADD sites		Number of Compensation Sites		Total HADD Area (m ²)	Total Compensation Area (m ²)
		Proposed areal footprints	Unknown or non-areal footprints	Proposed areal footprints	Unknown or non-areal footprints		
BC Interior	65	95	16	77	34	181,808	208,297
Lower Fraser	64	78	26	80	24	214,954	164,029
North Coast	22	23	0	16	7	71,766	81,498
South Coast	70	69	13	54	28	255,782	200,538
YTRA *	10	6	6	5	7	196,210	117,025
EAMP *	9	13	2	15	0	561,678	390,867
TOTAL	240	284	63	247	100	1,482,198	1,162,254

* YTRA = Yukon Transboundary Rivers Area; EAMP = Environmental Assessments and Major Projects

The total measureable HADD and compensation area was 1,482,198 m² and 1,162,254 m² respectively (Table 1). The EAMP group accounted for the greatest measureable HADD and compensation footprint, even though it represented only 9 authorizations and 4% of the total number of HADDs authorized. The authorized HADD footprint for the North Coast Area was less than half of that authorized in any other Area. The BC Interior and the Lower Fraser Areas had the largest number of proposed HADD and compensation sites, even though the South Coast had the most number of authorizations issued. A greater proportion of compensation sites (40%) had unknown or non-quantified proposed footprints than HADD sites (22%).

For each authorization, the type of habitat (e.g. in-channel, lacustrine, etc.) affected by HADD or compensation activities was identified. Of the HADD sites, 74% provided information on functional attributes of the habitat monitored (i.e. spawning, rearing, etc.) and 77% provided information on the fish species to be affected by construction. Most authorizations included some form of locational information (e.g. legal description or street address) for construction sites; however, only 28% provided geographically referenced coordinates (UTM or Latitude and Longitude).

3.2. Fish Habitat Affected

Complete information on the areal extent of HADDs and their associated compensation was only available for a subset of 232 sites within 163 authorization files. For this subset, the total proposed HADD and compensation area was 1,246,953 m², and 1,130,687 m² respectively (Table 2). Thus, overall there was 9% less area proposed in compensation as was proposed to be affected by HADDs. However, this total net difference may not be fully representative for a number of reasons. First, sites with unknown or non-areal measures of HADD or compensation could not be included in the analysis. Second, freshwater environments, with the exception of lacustrine habitats, had compensation to HADD balances that were positive, with 35% more compensation required than HADD proposed. Compensatory offsets in the marine environment were negative relative to proposed HADD footprints, largely owing to the subtidal dredging at Deltaport where the HADD footprint was 439,000 m² and the compensation footprint was 224,000 m² with a difference between them of 215,000 m².

The frequency of HADD and compensation sites along with their respective footprint is classified by habitat type in Table 2. In-channel and riparian habitat types respectively accounted for 41% and 28% of authorized HADD and compensation sites. Three estuarine habitat classes together constituted 5% of HADD and compensation sites ($\chi^2 = 405.67$, $df = 9$, $p\text{-value} < 2.2e-16$). The marine-unspecified habitat type had the largest proposed HADD area, with only 50% of the same area proposed as compensation. Within this habitat type, 70% of the HADD area was attributed to one port development project, an EAMP authorization file. This project's proposed compensation footprint was less than half of the proposed HADD, and therefore, is primarily responsible for the large negative areal balance seen for this habitat type and for this subset of files overall.

The marine-intertidal, estuarine-subtidal and lacustrine habitat types also showed a negative balance in terms of compensation (Table 2). In contrast, 60% of in-channel and 20% of riparian habitat types required surplus compensation in excess of the total area proposed to be taken as HADD for each habitat type. Due to a relatively high number of unknown or non-quantifiable HADD and compensation areas in the in-channel (HADD = 23% and Compensation = 33% of 149 sites respectively in N = 240 files) and riparian (HADD = 21% and Compensation = 31% of 100 sites respectively in N = 240 files) categories, the total HADD and compensation areas for these habitat types is likely substantially underrepresented in the data.

The relationship between the compensation area and the HADD area for 163 authorization files for which areal measures were available for both elements, is illustrated in Figure 2. The median compensation ratio was 1.25:1 across this subset of files. 75% of the files had a compensation ratio of 2:1 or less, and 27% of had a compensation ratio that was less than 1:1. The median HADD and compensation areas for these authorizations were 792 m² and 993 m² respectively. 76% of HADD sites and 75% of compensation sites had areas less than or equal to 4000 m². Because unknown or non-areal HADD and compensation footprints for some habitat types in files

examined were excluded from this regression analysis, inferences based on this relationship may be biased.

Table 2: The number and total quantifiable area of paired HADD and Compensation in each habitat type across a subset of 163 authorization files for which areal measures were available for both HADD and compensation elements.

Habitat Type	Number of HADD and Compensation Sites	Total Area (m ²)		
		HADD	Compensation	Balance
In-channel	95	264,551	426,413	161,862
Off-channel	8	8,254	15,767	7,514
Riparian	65	225,433	268,282	42,850
Lacustrine	9	34,497	13,163	-21,333
Total Freshwater	177	532,735	723,625	190,893
Estuarine-unspecified	5	50,455	70,069	19,614
Estuarine-intertidal	5	10,944	13,804	2,860
Estuarine-subtidal	2	5,750	3,048	-2,702
Marine-unspecified	36	626,489	313,348	-313,141
Marine-intertidal	7	20,582	6,794	-13,788
Marine-subtidal	0	-	-	-
Total Marine/Estuarine	55	714,220	407,063	-307,157
GRAND TOTAL	232	1,246,955	1,130,688	-116,264

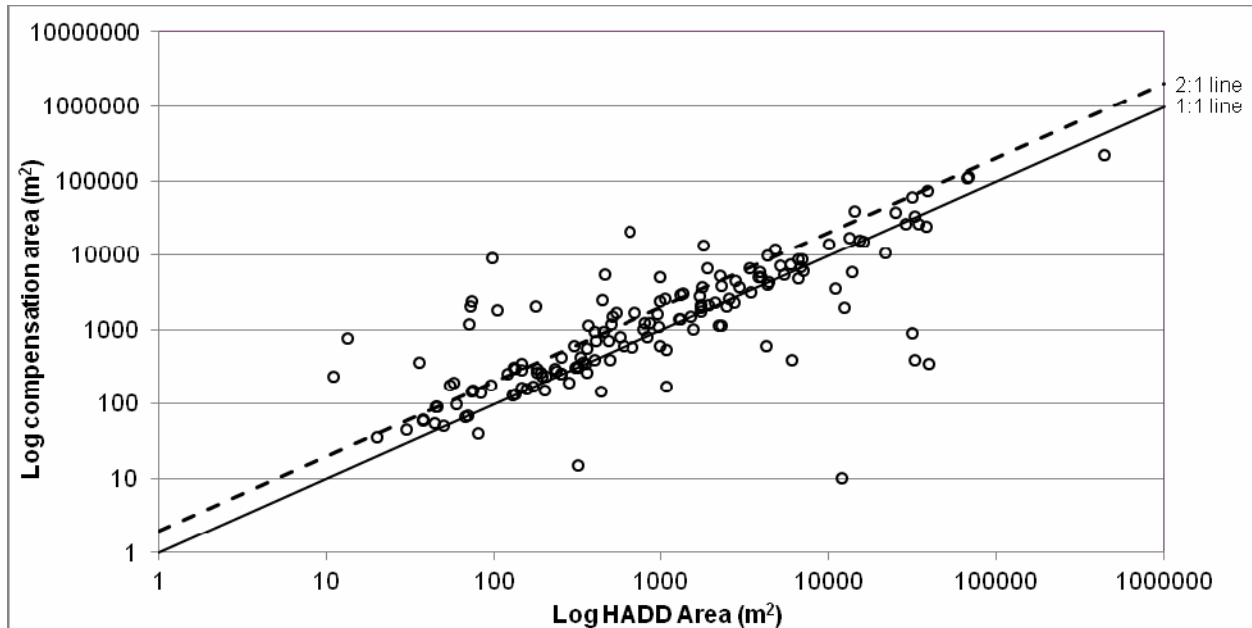


Figure 2: Compensation area as a function of HADD area (N = 163 files) for authorizations where areal measures were available for both HADD and compensation elements. The diagonal lines on the figure represents a compensation ratio of 1:1, (i.e. where the Log Compensation Area = Log HADD Area), and a compensation ratio of 2:1. 7 files of the 163 examined had a compensation area of 0 m², and as a result do not appear on the plot due to log-scaling.

3.3. HADDs

Fifteen different land use activities were identified for the 240 authorizations reviewed (Table 3). Rural-urban development, roads and highways, forestry, industrial development, transportation, and urban development accounted for over 60% of authorizations ($\chi^2 = 66.12$, $df = 14$, $p\text{-value} = 9.63\text{e-}09$). Industrial land use accounted for the highest total proposed HADD area (508,987 m²) followed by mining (169,163 m²) and transportation (166,450 m²).

Table 3: The number and total proposed HADD and Compensation footprints for authorizations reviewed (N = 240 files). Note: 77 of the files had incomplete areal information for either the HADD or compensation elements.

Land Use	Number of Authorizations	HADD Area (m ²)	Compensation Area (m ²)
Agriculture	13	60,627	59,177
Aquaculture	4	111,277	25,929
Forestry	23	20,258	43,744
Hydro	10	16,069	23,996
Industrial	25	508,987	290,629
Mining	8	169,163	79,254
Oil and Gas	16	34,586	19,716
Other	10	22,670	44,603
Private Land	4	3,379	7,116
Railway	14	63,189	62,107
Recreation	11	19,954	5,533
Roads and Highways	25	85,169	115,383
Rural Urban Development	34	126,739	97,696
Transportation	22	166,450	250,220
Urban Development	21	61,682	37,153
TOTAL	240	1,470,198	1,162,254

When comparing the subset of files (N = 163) for which complete areal information was available for both the HADD and compensation elements (Fig. 3), the total proposed compensation footprint for recreation, aquaculture and industrial land use was 21%, 23% and 57% respectively of the total proposed HADD footprint. In contrast, the total proposed compensation footprints for oil and gas and forestry were more than twice the proposed HADD footprint. Transportation, roads and highways, and mining were required to provide 1.5 times more compensation than their total proposed HADD footprints. Mean HADD areas and mean compensation areas did not differ significantly between different land-use activities (ANOVA for HADDs: $df = 14$, $F = 1.13$, $p\text{-value} = 0.33$; ANOVA for Compensation: $df = 14$, $F = 0.84$, $p\text{-value} = 0.63$).

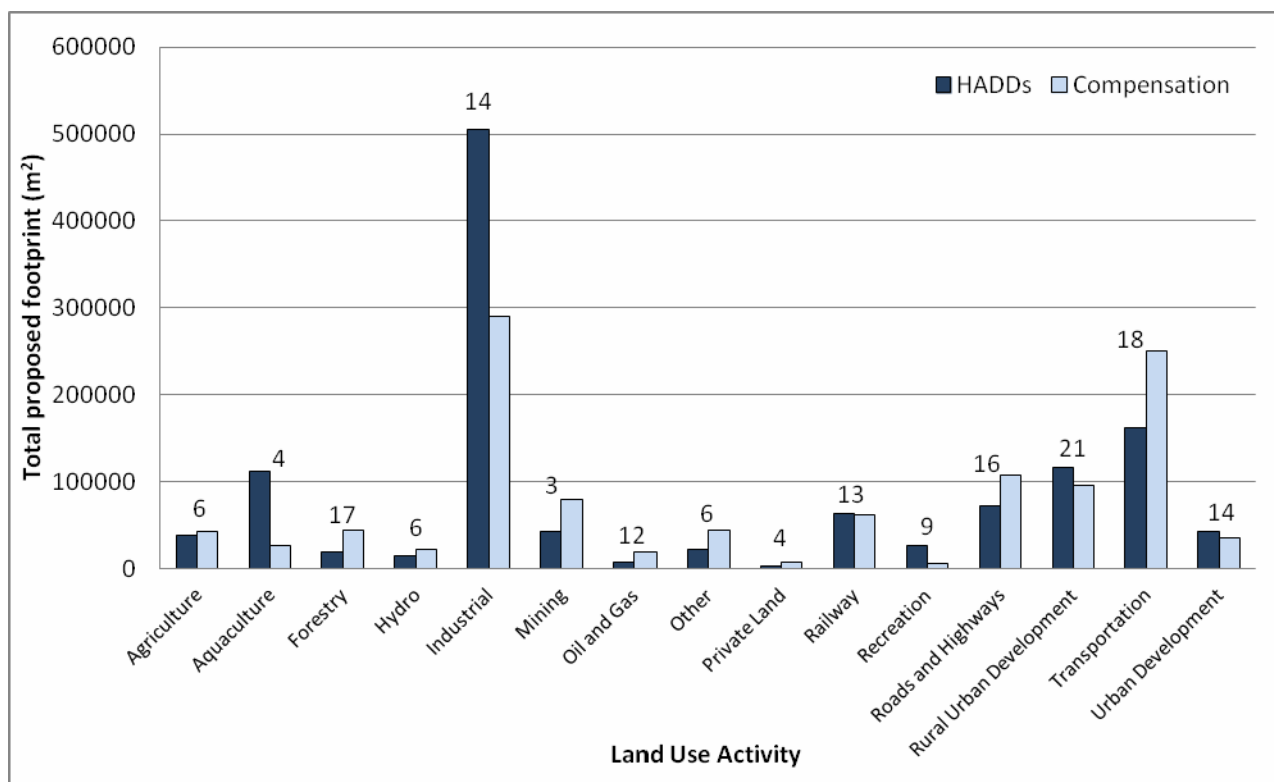


Figure 3: Paired HADD and compensation footprints by land use activity (N = 163 files). Only files with complete areal information for both the HADD and compensation elements were included in this subset. Counts above bars represent the number of authorization files for each type of land use activity.

Monitored sites were further classified by the type of development activity that occurred. Development activities fell into 29 different categories including, culvert installation, bridge construction, channel relocation, habitat enhancement, etc. (Fig. 4). Bank protection, channel relocation, culvert installation, bridge installation, log handling facility, and other development together accounted for 51% of the total proposed HADD area for authorizations reviewed (N = 240 files).

For the subset of files (N = 163) where complete areal information was available for the HADD and compensation elements, footprints were not available for two development activities, dam decommissioning and bridge rehabilitation (both activities are therefore excluded in Fig. 4). Port development accounted for largest proportion (35%) of the total proposed HADD area of all development activities, however, the compensation area required for this development activity was approximately 50% of the total proposed HADD area. Operation of a net pen facility accounted for the third largest HADD area, yet only required 23% of the total proposed HADD area in compensation for the HADD. Dike construction, road and highway construction, and habitat enhancement required more than two times the proposed HADD footprint in compensation.

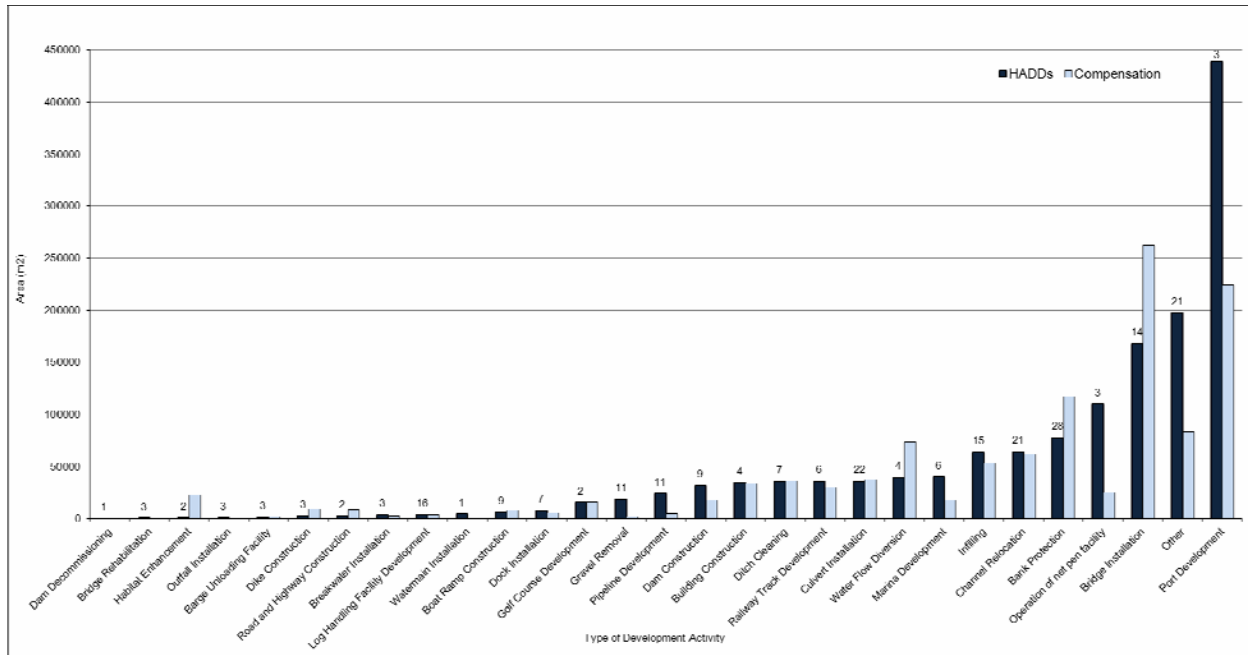


Figure 4: Paired HADD and compensation footprints by development activity (N = 163 files). Counts above bars represent the number of authorization files for each type of development activity.

The value of affected habitat was identified as 'critical', 'important' or 'marginal', as outlined in DFO's *Habitat Conservation and Protection Guidelines* (1998). Where no value was assigned the habitat value was designated as unspecified. For authorizations reviewed (N = 240), 6% resulted in a HADD to critical habitat, 31% resulted in a HADD to important habitat, and 27% resulted in a HADD to marginal habitat ($\chi^2 = 50.4$, $df = 3$, $p\text{-value} = 6.57e-11$). Mean HADD area did not differ significantly by habitat value as evidenced by the overlapping 95% confidence intervals in Figure 5. Ratio of compensation also did not differ between habitats with critical, important and marginal value (ANOVA: $df = 3$, $F = 2.06$, $p\text{-value} = 0.11$).

Over 80% of authorization files (N = 240) had some form of rationale on file indicating why the HADD was acceptable to DFO and why the HADD was justified subject to an authorization. Rationales justifying HADDs were provided either by habitat value, due to emergencies (e.g. threats to public health and safety), in project rationales, or in compensation designs.

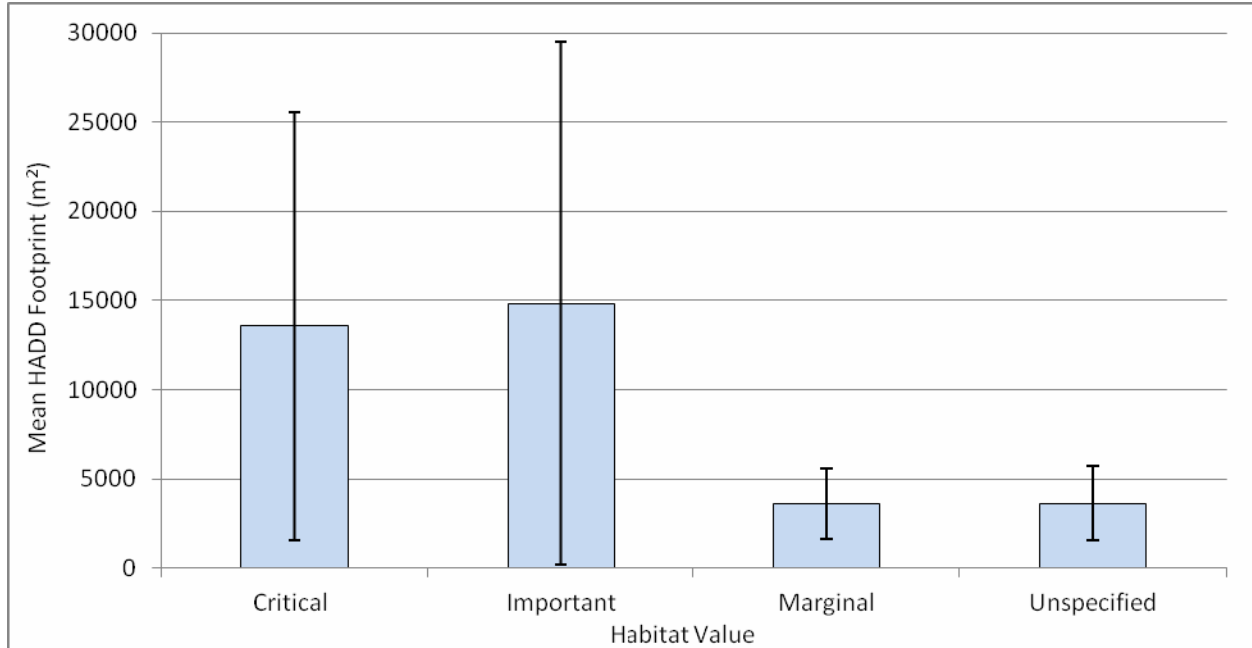


Figure 5: HADD footprints by value of habitat affected, for all files where an areal measure of the HADD was available (N = 201).

3.4. Compensation

Creation of in-kind (like for like) habitat on the same site as the HADD was the most common compensation option used (48% of files) ($\chi^2 = 290$, $df = 7$, $p\text{-value} < 2.2e-16$) from DFO's hierarchy of preferences for compensation (DFO 2002). In-kind offsite compensation and the ecological rationale compensation option (i.e. restorative works projects or projects with mixed compensation) made up another 21% of the total authorizations issued (Fig. 6). In keeping with the *Habitat Policy* (DFO 1986), artificial propagation was used in only 1% of authorizations issued, making it the least preferred option. In 7% of files, other compensation options (e.g. restrictive covenants) may have been considered or used; however, this information was unspecified, unknown or not available at these sites. Compensation costs were documented in 29% of authorizations issued, with the majority of files (62%) providing no estimate of costs. Similarly, monitoring costs were not provided in 76% of files.

Proponents were documented as being conformant with mitigation measures in 50% of authorizations issued, and non-conformant in only 5% of files. In a large proportion of files (45%), conformance with mitigation measures was documented as unknown (Table 4). Compensation 'As Built' information was provided in 55% of files and either not provided, unknown or not available in the remainder of authorizations issued. Proponents were identified as compliant with compensation in 63% of files and partially compliant or non-complaint in 7% of files, with compensation compliance status designated as 'unknown' or 'not applicable' for the remaining 30% of files.

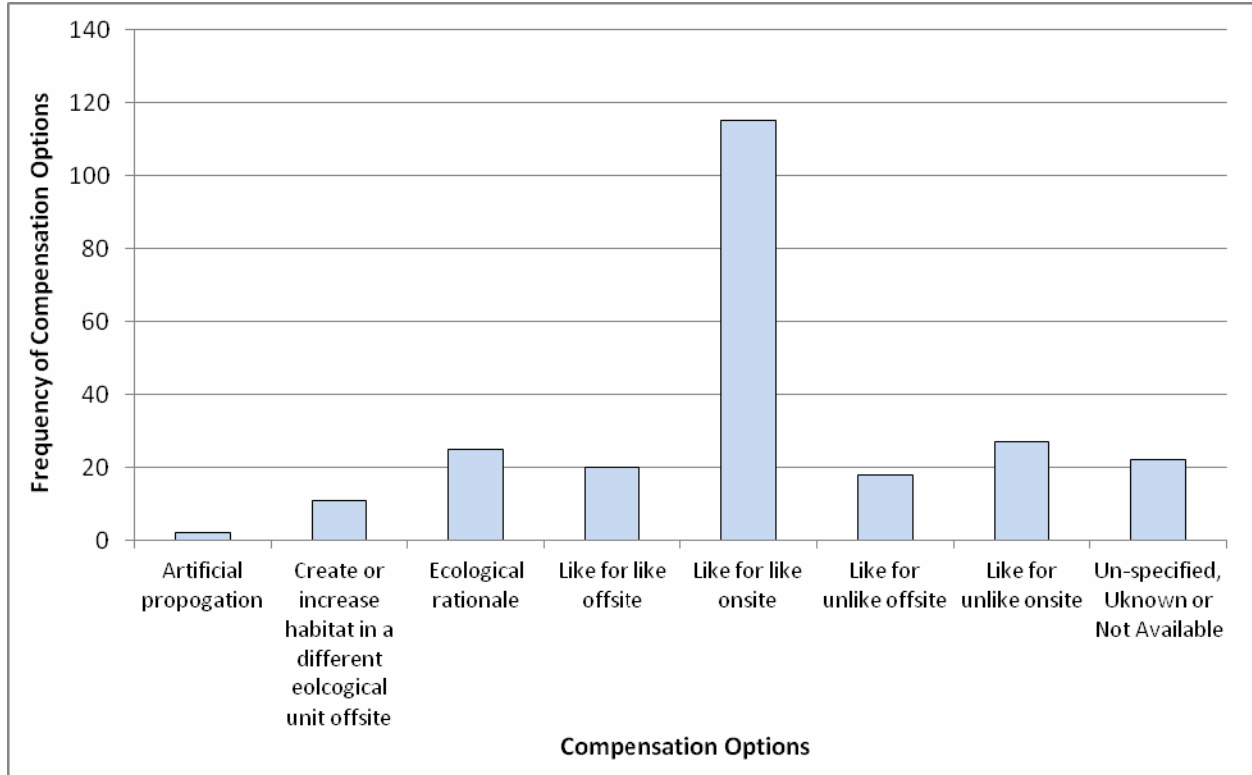


Figure 6: Frequency of compensation options from DFO's hierarchy of preferences (DFO 2002). The ecological rationale compensation option is not a component of DFO's hierarchy of preferences for compensation, but is included for comparison.

Table 4: Compliance and effectiveness expressed as proportions of the 240 authorization files reviewed.

Outcome	Mitigation Conformance	Compensation Compliance	Monitoring Compliance	Compensation Monitoring Reports kept Up-to-date	Achievement of NNL based on areal footprint*
Yes	50%	63%	38%	29%	50%
No or Partial	5%	8%	40%	63%	15%
Unknown or Not Applicable	45%	29%	22%	8%	35%

*A surrogate for NNL was achieved if the ratio of the proposed Compensation to HADD footprint was equal to or greater than 1.0. However, this metric does not include an assessment of losses or gains in the productive capacity of habitat affected as defined in the Habitat Policy (DFO 1986).

3.5. Project monitoring

Pre-impact assessments were conducted for 88% of files reviewed (N = 240), while 12% of files either had no pre-impact assessment performed or the status was unknown (Fig. 7). Pre-impact and post-construction assessments were categorized based on their level of rigor and were defined as per Harper and Quigley (2005b).

Of the pre-impact assessments that were completed, 31% were classified as Basic, 52% as Type 2, 15% as Type 1, and 2% as Research ($\chi^2 = 197.57$, $df = 4$, $p\text{-value} < 2.2e-166$). Post-construction monitoring was required for 84% of authorization files reviewed. The requirement for post-construction monitoring could not be determined for 15% of files reviewed, and in 1% of cases, no post-construction monitoring was required. Of the files where post-construction monitoring was required, 20% were classified as Basic, 63% as Type 2, and 17% as Type 1 ($\chi^2 = 171.98$, $df = 3$, $p\text{-value} < 2.2e-16$). One file was classified as Research.

Comparison of the proportion of files in the Basic, Type 1 and Type 2 pre-impact assessment classes with the proportion of files in the same post-construction monitoring classes showed that the level of rigor and information gathered tended to differ between pre-impact and post-construction assessment of sites. Basic assessment had the greatest difference followed by the Type 2 assessment ($\chi^2 = 8.22$, $df = 3$, $p\text{-value} = 0.042$) (Fig. 7). For only 61% of authorization files the pre-impact assessment class matched the post-impact assessment class, making it difficult to compare pre- and post-construction assessments and evaluate habitat effects for a large proportion of authorization files, as also noted by Harper and Quigley (2005 a, b).

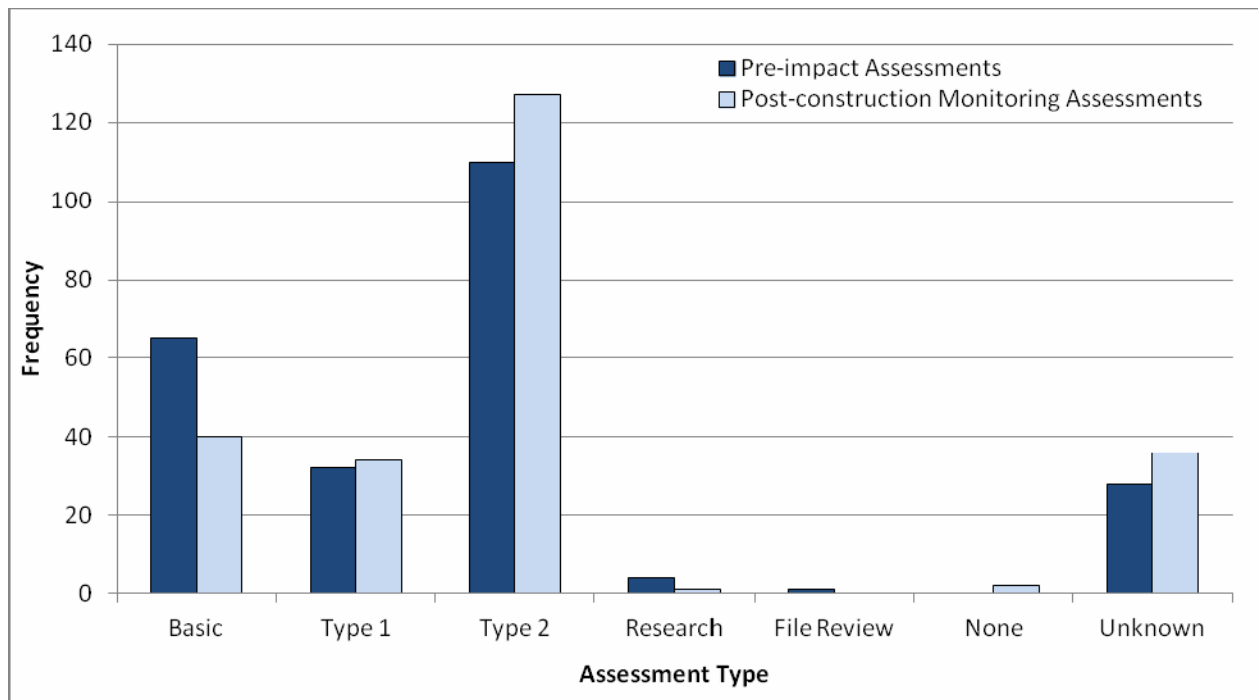


Figure 7: Frequency of pre-impact assessments and post-construction monitoring assessments in authorization files reviewed (N = 240).

Performance criteria for compensation projects were stipulated in 88% of authorizations (N = 240), with 40% of files having qualitative performance criteria defined, and 48 % having quantitative and measureable performance criteria defined. Compensation monitoring reports were largely not kept up-to-date, with 63% of files identified as having reports not kept up-to-date and only 29% of files having reports kept up-to-date

(Table 4 above). The status of compensation monitoring reports for the remaining 8% of reviewed files was either unknown or could not be determined ($\chi^2 = 110.77$, $df = 2$, $p\text{-value} < 2.2e-16$).

The duration of monitoring programs for authorizations reviewed ranged from 1 to 11 years, with a mean duration of 4.6 years (SE: 0.22, $N = 140$). The monitoring duration was not related to the size of the HADD ($R^2 = 0.01$, $df = 187$, $p\text{-value} = 0.12$), but was related to the size of the Compensation ($R^2 = 0.05$, $df = 160$, $p\text{-value} < 0.01$) and the habitat value (ANOVA; $F = 3.15$, $df = 3$, $p\text{-value} = 0.02$). Proponents were often found to not be meeting their monitoring requirements, with 40% of reviewed files being assessed as having either not met or only partially met their monitoring requirements. Proponents fully met their monitoring requirements in 38% of files, while the monitoring status of 22% of files could not be determined (Table 4). Monitoring duration did not appear to affect adherence to monitoring conditions, as the proportion of authorizations that were partially compliant or non-compliant with monitoring requirements was similar in each monitoring interval examined (Fig. 8).

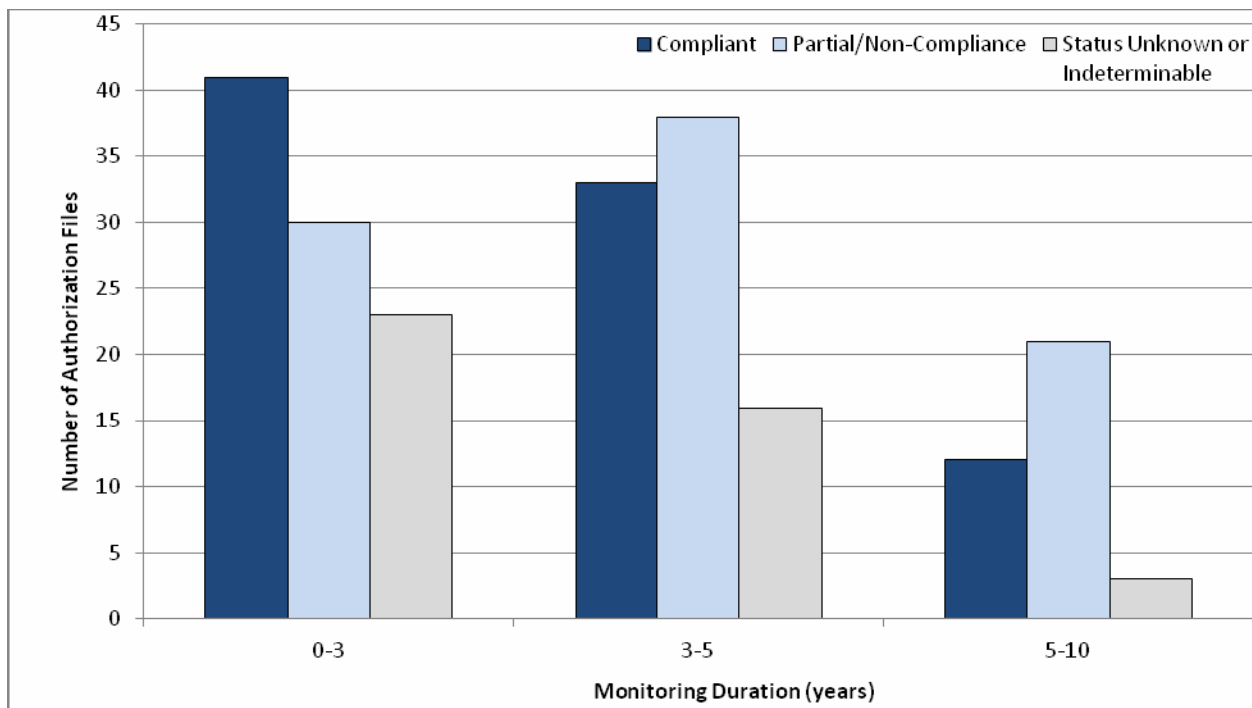


Figure 8: Monitoring compliance status of authorizations (N = 217) in relation to the duration of monitoring.

3.6. Financial Securities

DFO often requires proponents to submit letters of credit in order to provide financial security to ensure that any proposed compensation works, accompanying monitoring programs, and any remedial works deemed necessary to adequately compensate for the HADD are successfully completed. Financial security was required for 50% of

authorization files reviewed (N = 240). The remaining 50% of files either did not require financial security or this information was not available. Of the files for which financial security was required, 58% provided detailed information regarding financial security requirements, 26% provided non-specific information on the financial security requirements and the remaining files were provided with blanket security ($\chi^2 = 4.83$, $df = 2$, $p\text{-value} = 2.74\text{e-}08$). The duration of time that financial securities were held for was not available within the files reviewed. There was a significant difference in compensation compliance and achievement of NNL with retention of financial security (Compensation compliance: $\chi^2 = 11.24$, $df = 2$, $p\text{-value} = 0.004$; Achievement of NNL: $\chi^2 = 16.41$, $df = 2$, $p\text{-value} < 0.001$). However, there was no significant relationship between retention of financial security and monitoring requirements being met ($\chi^2 = 3.41$, $df = 2$, $p\text{-value} = 0.18$).

3.7. Compliance and Effectiveness

It was difficult to assess adherence with stipulated mitigation, compensation and monitoring measures because the status was unknown or not available for a large proportion of files reviewed (Table 4). The HMU was unable to adequately assess whether compensation projects had successfully met stipulated performance criteria because this data was not available. Thus, overall effectiveness of compensation projects remains undetermined in this review.

Determination of NNL as defined in the *Habitat Policy* (DFO 1986) was not possible because no measure of productive capacity was available for the files examined in this study. However, use of a surrogate for NNL based on comparison of proposed HADD and compensation footprint size alone suggested that 50% of files successfully balanced areal loss of habitat (Table 4) by providing an equivalent amount or more habitat than was lost. The remaining files either did not adequately compensate for the HADD area or a determination could not be made due to incomplete data.

4.0. DISCUSSION

This study followed an approach similar to Harper and Quigley (2005b) in which they examined project files for *Fisheries Act* authorizations from across Canada; however, only authorizations issued between 2002 and 2006 within Pacific Region were examined here. During this period some of the preliminary findings and recommendations that were later contained within Harper and Quigley (2005b) were already beginning to influence program activities within Pacific Region. In this regard, this audit serves to provide a comprehensive examination of authorization practices specific to Pacific Region and to establish a baseline that could be used to identify trends and evaluate adjustments to the Habitat Management Program.

4.1. Record Keeping

Similar to the findings of Harper and Quigley (2005b), record-keeping was an issue for Pacific Region authorization files. Many files were incomplete or had data gaps that

made it difficult to quantify habitat losses and gains and assess the effectiveness of compensation works. For example, only 163 of the 240 files reviewed contained adequate areal information for both the HADD and compensation sites. The information contained in the files only permitted a limited examination of habitat gains and losses, as the productivity of affected habitats could not be assessed, restricting our examination of productive capacity to a determination based on areal footprint alone.

Some facets of record keeping were better in comparison with the national dataset examined by Harper and Quigley (2005b). For instance, all files reviewed in our study identified the type of habitat affected, and in almost 75% of cases provided information on functional attributes of the affected habitat. In contrast, Harper and Quigley (2005b) noted that the habitat type affected was often not specified, and functional attributes were rarely identified. They also noted that none of the files they audited included geographically referenced coordinates for site locations while this study found that 28% of Pacific Region authorization files contained this information.

A key criticism in Harper and Quigley's assessment (2005b) was the failure on the part of DFO to provide supporting rationales for why HADDs were authorized under the *Fisheries Act*. They noted that failure to provide such rationales compromised DFO's corporate memory and organizational learning potential, while also contributing to a perceived lack of transparency in decision-making with respect to fish habitat. In our study, over 80% of authorization files reviewed had some form of supporting rationale indicating why the HADD was acceptable to DFO and why the HADD was justified subject to an authorization under the *Fisheries Act*. A formal project rationale was documented for almost 70% of the files reviewed in comparison to the 20% observed in Quigley and Harper (2005b). Pacific Region's improvements in this facet of record-keeping help to increase accountability in decision-making, and allow DFO to better assess the outcomes of decisions and adapt accordingly.

4.2. Habitat Impacts

A total of 240 authorizations files were issued in the Pacific Region from 2002-2006, averaging 48 files per year. The South Coast, Lower Fraser and BC Interior Areas issued the vast majority of the authorizations (Table 1). The higher numbers of authorizations in these Areas likely corresponds to increased levels of population and development. However, the numbers may also be influenced by how likely proponents in the various Areas are to submit their projects for review. It is possible that some Areas may have had higher levels of unauthorized HADDs. An estimated 1,482,198 m² of HADD was proposed and 1,162,254 m² of Compensation was proposed to offset the HADDs (Table 1), suggesting a Regional Compensation shortfall of approximately 320,000 m². However, the total HADD and Compensation areas provided in Table 1 omit unknown or non-quantified footprints. To more accurately compare HADD and compensation footprints, only sites with quantified footprints for both elements were considered (Table 2). This comparison showed an estimated combined shortfall in compensation of approximately 116,000 m² overall. This total shortfall value may not be fully representative as 77 authorization files could not be included due to missing or non-areal data. It should also be noted that this areal assessment does not consider

the productivity of the proposed HADD or compensation sites. The majority of the areal habitat loss in Pacific Region was in the marine-unspecified habitat type, a single port development project was responsible for the bulk of the negative habitat balance. A similar observation was noted by Harper and Quigley (2005b), who found a negative habitat balance for marine sub-tidal habitats.

Compensation rates required by DFO were found to be meeting No Net Loss objectives in some habitats. The positive compensation to HADD balance for freshwater habitats shown in Table 2 suggests that the No Net Loss principle was applied by DFO staff. Further, the negative compensation to HADD balance shown in the marine habitats,, is likely explained by lack of opportunity to compensate in like-for-like fashion. In these cases, creation of smaller compensation sites with higher productivity values could still achieve No Net Loss in productive capacity, which would not be reflected in areal calculations. Likewise, the negative compensation balance seen in lacustrine habitats (Table 2) could also be explained by the lack of opportunity to create like-for-like compensation in lakes and DFO accepting the creation of higher productivity compensation habitats of lesser areal extent than the HADDs.

While most authorizations had a compensation ratio greater than 1:1, 27% of files proposed a compensation ratio of less than 1:1. This latter proportion is very similar to that in Harper and Quigley (2005b), where 25% of authorization files reviewed had compensation ratios of less than 1:1. The high congruency between these findings suggests that there were few if any differences in the way compensation ratios were determined for authorizations reviewed in Harper and Quigley's National dataset and our Pacific Region dataset. Similarly, Harper and Quigley (2005b), calculated a median compensation ratio of 1.13:1, while the compensation ratio of the files we reviewed (N = 163) was 1.25:1, suggesting very little difference in the allocation of compensation. More importantly, given that a large proportion of the HADD footprints from the files reviewed were in 'critical' or 'important' habitat (Fig. 5), there is a risk that low compensation ratios may not be adequately compensating for the value of habitat lost. In fact, there was no difference in mean compensation ratio by habitat value (Fig. 9 below), suggesting that assessed habitat value did not influence the determination of compensation ratios. However, an important underlying assumption here is that the HADD results in complete destruction or removal of existing habitat. This may not necessarily be the case, as the HADD may result in a habitat conversion (i.e. a change in the function or value of the habitat), affecting the value of the habitat as a result. Assessors likely account for this in their determination of the footprint and kind of habitat required as compensation for the HADD. Thus, varying compensation ratios are possible, and in some cases these ratios may be less than 1.0, but still offset the HADD because high value habitat is provided in compensation or because the HADD itself was an alteration or disruption rather than habitat destruction.

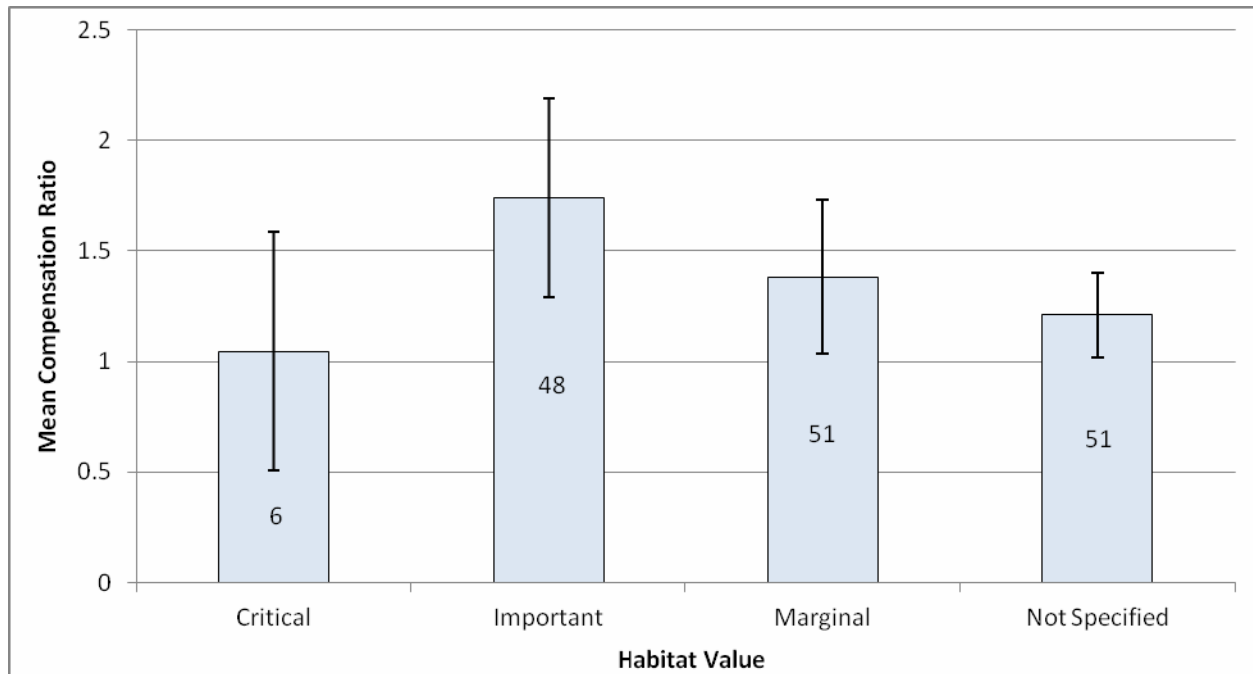


Figure 9: Average compensation ratio by value of habitat affected. The Numbers on each bar are counts of the files within a habitat value category. 7 files with compensation ratios greater than 10.0 were dropped as outliers.

Different forms of habitat conversions were regularly observed during Regional habitat monitoring in 2011 (Carter et al. 2013), where in some cases the HADD site was determined to have resulted in only minor changes or even a net increase in the value of habitat (e.g. excavation within a stream channel that resulted in increased habitat complexity for resident fish species). Such an analysis was not possible for the data set examined in this report, but consistently applied qualitative assessments by trained biologists can be used to better examine achievement of *Habitat Policy* (DFO 1986) goals, in the face of varying requirements for balancing habitat impacts.

As per DFO's hierarchy of preferences for compensation options, most files (56% of 240 files) provided in-kind compensation for the authorized HADDs. The majority of these were completed on the same site as the HADD. This observation is similar to that observed by Harper and Quigley (2005b), who suggested that the in-kind compensation should be the most effective option for maintaining or increasing the productive capacity of affected habitat. In terms of record-keeping however, almost 10% of files either did not specify the compensation option used or this information was not available in the file. Such information should always be documented to adequately assess DFO's performance in meeting policy directives regarding compensation.

Culvert installation, channel relocation, bank protection, and bridge installation were the development activities that resulted in most of the HADDs requiring authorization (Fig. 4). As a result it is not surprising that in-channel and riparian habitats were the most frequently affected by HADDs. In their study, Harper and Quigley (2005b) noted

similar results, suggesting that development activities affecting in-channel and riparian habitat continue to be the most prevalent projects proposed and authorized. Furthermore, they stress the importance of developing consistent and effective mitigation and compensation strategies for impacts from these types of development activities, as the cumulative losses from each of these activities could result in significant impact over time. Our results suggest that the proposed compensation area for many development activities in Pacific Region may be inadequate to offset the HADD area proposed. To stem incremental habitat losses resulting from the proverbial 'death by a thousand cuts,' DFO should be requiring compensation in excess of the HADD. The level of risk to fish and fish habitat associated with development activities should be verified through compliance monitoring, and the effectiveness of different compensation strategies to offset the risks and habitat impacts associated with these activities needs to be examined.

4.3. Compliance and Effectiveness

It was difficult to adequately assess proponent adherence to compensation and monitoring requirements, and conformance with mitigation measures because the status of these factors was often either not available or unknown for a large proportion of files examined (Table 3). This observation was attributable to poor record keeping on the part of DFO and lack of adherence to reporting requirements on the part of proponents. In many cases, the relative importance of these two causal factors could not be separated making it difficult to identify whether DFO or the proponent was accountable. Missing information in files profoundly limited our ability to evaluate performance. For instance, determining conformance with mitigation requirements (Table 3), suggests a very low rate of non-conformance (1%) however, such an interpretation may be very inaccurate because the status of 45% of files was unknown. This unknown status was derived when monitoring reports were not available for review, thereby obscuring the true nature of proponent conformance with mitigation. During the file review efforts were made to try and determine whether monitoring reports were not up to date because they had not been provided by the proponent or due to inadequate record-keeping, but it was often not possible to conclusively determine the cause. Harper and Quigley (2005b) noted similar findings in their report, emphasizing the need for better record keeping and increased compliance monitoring and enforcement by DFO.

Retention of financial security has been identified as an important means for ensuring proponent compliance and conformance to requirements. In our study, only half of the authorizations reviewed required financial security, however, this is still 16% higher than the National rate noted by Harper and Quigley (2005b). We were unable to ascertain the number of financial securities exercised; however, this would have served as a valuable measure for assessing DFO's enforcement of compensation requirements in comparison to the actual rate of proponent compliance with compensation requirements. We did find that significantly more projects with financial security met their compensation requirements, but we also found no relationship between financial security and proponents meeting their monitoring and reporting requirements.

Determination of NNL as defined in the Habitat Policy (1986) was not truly possible using information gathered from project files, as we were unable to assess the productive capacity of habitats affected in the authorizations reviewed. Instead, we used areal footprints as a surrogate for NNL, where a project was deemed to have achieved NNL if the ratio of the required compensation footprint to the proposed HADD footprint was greater than or equal to 1.0. One significant limitation of this approach is that the productive capacity of HADD and compensation habitats are considered equivalent for a project. However, when compensation requirements are determined by DFO Assessors, consideration is given to the quality of habitat being provided as compensation to offset the HADD, therefore, the NNL ratio could be less than 1.0.

We were able to make an areal determination of NNL for 65% of files examined in our study, while Harper and Quigley (2005b) were only able to make such an assessment for 14% of files in their national study. This substantial difference is likely a result of improvements in quantifying and recording project footprints since the end of Harper and Quigley's study period, and is also likely due to better quantification and recording of project footprints in the Pacific Region in comparison to the national norm. Of the 156 files for which an areal determination of NNL was possible, only 50% successfully achieved NNL, suggesting that on the basis of areal footprint alone, NNL is not being adequately achieved. A similar result was observed by Harper and Quigley (2005a), in their meta-analysis of compensation projects, which found that 64% of projects achieved NNL. However, this simple areal assessment overlooks potential differences in the productive capacity of the HADD and compensation sites. When the assessment of areal footprints was limited to just projects identifying like for like compensation (N = 96 files) the achievement of NNL was 80% which may be more representative as it is not complicated by evaluations of differing habitat types. Harper and Quigley (2005b) suggested that a standardized approach to designing and implementing monitoring programs is necessary to assess the effectiveness of habitat compensation in achieving NNL, and this recommendation holds true for our study as well.

A review through the Canadian Science Advisory Secretariat (CSAS) has recently been initiated on the Monitoring Design and Metrics to Assess the Effectiveness of Habitat Compensation Activities. One of the early outcomes of the review was the recognition that quantitative functional monitoring that relies on surrogates to assess changes in productive capacity when used in combination with expert opinion can yield valuable information on program outcomes. In Pacific Region the Habitat Monitoring Unit has used the structured approach of the Risk Management Framework (RMF) (DFO 2006) to quantify and assess the observed residual effects of HADDs and characterize the scale of negative effect (extent, duration and intensity) they pose to fish and fish habitat in the context (sensitivity, dependence, rarity and resiliency) of the fish and fish habitat being effected. The RMF approach incorporates the scale of negative effect and sensitivity of the fish and fish habitat in order to characterize the level of risk a development proposal poses the productive capacity of fish habitat. For monitoring purposes the RMF approach has been used to evaluate the observed benefits of compensation works and determine whether they successfully offset observed residual effects associated with the HADD (Carter et al. 2013).

5.0. CONCLUSIONS

Overall, our findings relating to *Fisheries Act* Section 35(2) authorizations and fish habitat compensation in Pacific Region are similar to the National results reported by Harper and Quigley (2005b). We found some improvements in record keeping and the documentation of decisions, but information gaps were still apparent. The reporting of proponent-lead monitoring was inconsistent and their evaluation of compensatory habitat rarely allowed determination of whether the goal of NNL was achieved.

Our findings indicate that the Habitat Management Program in Pacific Region needs to continue improving its record-keeping and documentation of the rationale for management decisions. Efforts need to be made to standardize monitoring programs to ensure they allow objective evaluations of the performance of mitigation and compensation measures.

In-channel and riparian habitats are the most impacted by development activities, and in most cases these projects tend to impact high value habitats. The results of this study and previous work (Harper and Quigley 2005 a, b) show that the compensation ratio for development projects on average is close to 1:1, suggesting that DFO should assume a precautionary approach and adopt higher compensation ratios to avoid losses in habitat productivity associated with these higher value habitats. In order to adequately evaluate if NNL is being achieved post construction, the level of risk to fish and fish habitat associated with development activities should be verified through compliance monitoring.

In the Pacific Region, the Habitat Monitoring Unit has utilized the Risk Management Framework (RMF) approach along with quantitative project footprint measurements and biophysical measurements as per the recommendations of Quigley et al. (2006). In the absence of a quantitative measure for habitat productivity, the RMF approach serves as a good tool to evaluate whether compensation ratios are adequate, and whether the habitat provided in compensation is adequate to offset losses in habitat productivity associated with the HADD.

To examine DFO's progress and performance in achieving NNL, a similar audit of authorization files should be conducted at a regular interval. A 6-year reporting interval is recommended, as this cycle corresponds to the reporting cycle for the Regional Random Sample of Referrals in the Pacific Region. The findings in each report have bearing on the other, and can serve to provide valuable insight on departmental progress in achieving policy goals.

In recent years, there has been an increased emphasis on compliance and effectiveness monitoring (DFO 2008) but adequate resources, proper training, and standardized approaches need to be developed and maintained to ensure the achievement of DFO's conservation and sustainability goals.

6.0. REFERENCES

- Carter, D.W., Klassen, H.D. and Bonamis, A.N. 2013 (in prep). Annual Monitoring Report for 2011 of the Habitat Monitoring Unit in Pacific Region. Can. Manuscr. Rep. Fish. Aquat. Sci. ____: xi + 85 p
- Fisheries and Oceans Canada (DFO). 1986. Policy for the management of fish habitat. Ottawa, 28 pp.
- . 1998. Habitat conservation and protection guidelines. Second edition. Ottawa, Ontario, Canada, 19 pp.
 - . 2002. Practitioners guide to Habitat Compensation. Ottawa, Ontario, Canada, 23 pp.
 - . 2006. Practitioners Guide to the Risk management Framework for DFO Habitat Management Staff. Version 1.0. in Habitat Management Program: Standard Operating Policies.
 - . 2008. Environmental Process Modernization Plan. 2005-2010 Strategic Plan: ur Waters, Our Future.
Available at: <http://www.dfo-mpo.gc.ca/dfo-mpo/plan-eng.htm#5a6>
- Harper, D.J., and Quigley, J.T. 2005a. A comparison of the areal extent of fish habitat gains and losses associated with selected compensation projects in Canada. Fisheries. Vol 30(2): 18-25.
- Harper, D.J., and Quigley, J.T. 2005b. No Net Loss of Fish Habitat: A Review and Analysis of Habitat Compensation in Canada. Environmental Management 3(36): 343–355.
- Quigley, J.T., Harper, D.J., and Galbraith, R.V. 2006. Fish habitat compensation to achieve no net loss: review of past practices and proposed future directions. Can. Tech. Rep. Fish. Aquat. Sci. 2632: vi + 22 p.
- R Development Core Team (2010). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, Accessible at: <http://www.R-project.org/>.

7.0. APPENDICES

7.1. Complete File Audit Methodology

1. Setting the sample population

The authorizations audited were those issued in the calendar years 2002 to 2006 inclusive. The files had an action of “Authorized” recorded within PATH. The HADD that was authorized must have occurred, and one full year of monitoring completed for the associated compensation works. In cases where additional authorizations related to the project had occurred, only authorizations directly related to the original authorization (e.g. an amendment to the original authorization that was issued within the same year) were included in the audit. Authorizations for separate aspects of the project that occurred outside of the 2002-2006 period were not audited.

2. Obtaining the hard copy files

The list of files generated from the PATH query was sorted by assessor and exported into an Excel spreadsheet. The assessors assigned to the file were requested to identify the location of all electronic and hardcopy documents associated with the file. The related documents included, but were not limited to the following:

- Proposal or site plan;
- Impact assessments - pre and/or post construction;
- Biophysical site assessment;
- CEEA screening report;
- Site visits;
- Estimate for the cost of compensation and monitoring;
- Authorization;
- Letters of credit;
- Monitoring reports (all received);
- Compensation as built drawings;
- HADD as-built drawings;
- Documents pertaining to any compliance issues; and
- Documents pertaining to the compensation being deemed to be functioning as intended.

Missing hard copy files were noted as such and were audited based on the information available in PATH or other electronic files.

3. Procedures for Auditing

First, files were checked to ensure they met the criteria to be included in the sample population: the HADD had occurred, and at least one year of monitoring had occurred. Files that did not meet the criteria were not included in the audit, and the reasons for their exclusion were recorded in the Audit Status column of the Authorization Audit File Status Tracking Sheet. The files that met the audit criteria were audited in the manner described in the following steps.

3.1 Within the Authorization Audit Access database the names of all the files that met the auditing criteria were entered into the Look-up (LU) Table: *Project Name* and assigned a Project ID number.

3.2 The PATH and hardcopy files were reviewed and all columns in the Authorization File Audit Excel spreadsheet were completed. The information from the Excel spreadsheet was then used to complete the required fields in the Access database. The fields were answered using the following rationale:

3.2.1 Project Information Screen

- Project Name – record as it appears in PATH
- Water body – record as it appears in PATH
- Proponent – record as it appears in PATH
- DFO contact – record as it appears in PATH
- Location Given – if the location was provided anywhere in PATH or in the hardcopy file. Select Yes (Y) or No (N)
- Location Type – Choose from the drop down list. If more than one location type is available, choose “multiple”
- DFO Contact – record as it appears in PATH
- Proponent Organization – Record as it appears in PATH

3.2.2 HADD Information Screen

- PATH Number – record as it appears in PATH
- Land Use – record as it appears in PATH
- Development Activity – Choose the best fit from the drop down list in the Excel spreadsheet.
- Description of the HADD - As described anywhere in the file.
Choose from:
 - 0 (no description)
 - 1 (general description)
 - 2 (specific description, with details quantified and/or broken out by category)
 - 3 (very clearly defined (as (2) above, but with mapped areas and pre- and post-HADD details))
- Habitat Value (recorded in the Excel Spreadsheet) – As described anywhere in the file. Choose from:

- 0 (proponent used the DFO definitions of habitat value)
 - 1 (the habitat value can be inferred from information in the file)
 - 2 (information is available in the file, but habitat value cannot be inferred)
 - 3 (no information was provided (unknown) because the file is missing)
- Habitat Value (recorded in the Access database) - As described anywhere in the file. The definitions in the Habitat Conservation and Protection Guidelines (1998) were used as habitat value guidelines. Choose from:
 - Critical
 - Important
 - Marginal
 - Not Specified
 - Justification of HADD Provided – HADD is considered “Justified” if three components are present: project rationale; habitat value; and compensation design. Select Yes or No.
 - Justification of HADD – Choose from the drop-down list options:
 - Compensation Design (if the value of the compensation was deemed to be the sole reason to allow the project to go ahead)
 - Project Rationale (if redesign, relocate, and mitigation measures were applied, and if it was important that the project occur)
 - Emergency (if the authorization was in ‘response/reaction’ to an emergency)
 - Unknown (if auditor was unable to determine why the HADD was authorized)
 - Habitat Value (historically, requiring application of redesign, relocate, mitigate in low to moderate habitat was not felt to be justified or was not required to be as strongly applied)
 - Compensation Options – based on the information in PATH and the hard copy file. When multiple compensation options were used, the primary/predominant type was recorded in the database. A note in the comments section may identify secondary compensation options. Choose from:
 - ECO (ecological rationale) – applies for “other” compensation types, such as restorative works or mixed compensation types.
 - HD (Hierarchy of Preferences, generic)
 - HD1ON (creation of like-for-like habitat onsite, within the same ecological unit)
 - HD1OFF (creation of like-for-like habitat offsite, within the same ecological unit)
 - HD2ON (creation of unlike-for-like habitat onsite, within the same ecological unit)
 - HD2OFF (creation of unlike-for-like habitat offsite, within the same ecological unit)

- HD3 (creation of habitat offsite, within a different ecological unit)
- HD4 (artificial propagation)
- NA (if compensation was not required for the project)
- UK (it is unknown which compensation option was used for the project, including when no information was available)

3.2.3 Habitat Information Screen

- Habitat Type – for each file, multiple habitat types can be recorded. The HADD and Compensation areas must be associated with the same habitat type entry so the ratio can be calculated. An exception to this can be made when there are two or more compensation sites, in which case the HADD and Compensation areas can be associated with the appropriate habitat type. Choose from:
 - ICH (in channel habitat)
 - OCH (off channel habitat)
 - RIP (riparian habitat)
 - LAC (lacustrine habitat)
 - EST (estuary habitat)
 - MAR (marine subtidal and intertidal habitat)
- Habitat Usage – choose from:
 - rearing
 - spawning
 - migration
 - holding
 - all
 - multiple
 - unknown
- Species Listed – select Yes (Y) if the species affected by the HADD is recorded in the file, or No (N) if the species affected by the HADD were not recorded in the file.
- HADD area – record the area of the HADD in square meters, but do not include the units (e.g. 104). If the HADD is recorded in a form other than area (e.g. number of trees, linear length, or volume), record the number but add the units after the number (e.g. 3 trees, 1203 m).
- Compensation area – record in the same way as HADD area above.
- Compensation technique – fill in:
 - Y (if the compensation technique was identified in the file)
 - N (if the compensation technique was not identified in the file)
 - NA (if compensation was not required for the project. Financial compensation is included as a technique, as long as it is adequately described.)
- Compensation Ratio – only calculated for those entries where both the HADD and Compensation Areas were recorded in meters squared (divide the Compensation area by the HADD area).

3.2.4 Cost and Financial Information Screen

- Cost of Compensatory Work provided – choose from:
 - Y (cost was provided)
 - N (cost was not provided)
 - UK (if file could not be found)
 - NA (if a separate cost estimate for the work was included in the file)
- Cost of Monitoring provided – choose from:
 - Y (cost was provided)
 - N (cost was not provided)
 - UK (if file could not be found)
 - NA (if a separate cost estimate for the monitoring was included in the file)
- Amount of Security Required – choose from:
 - 0 (no security required or no information available)
 - 1 (security was required but was not tied to specific details)
 - 2 (security was required and is tied to specific details)
 - 3 (blanket security was used)
- Duration of Financial Security – choose from:
 - 0 (no security required or no information available)
 - 1 (security was required but was not tied to specific details)
 - 2 (security was required and is tied to specific details)
 - 3 (blanket security was used)

3.2.5 Proponent Monitoring Information Screen

- Pre- and Post-assessment Class – pre-assessment refers to the pre-construction assessment of the habitat to be affected. Post-assessment refers to the assessment of the compensation works. Choose from:
 - Unknown (unknown status from the file, or the file is missing)
 - Basic (a qualitative assessment)
 - Type 2 (a quantitative assessment)
 - Type 1 (an extensive assessment)
 - Research (an experimental design)
- Frequency – how often the post-construction (compensation habitat) assessments (monitoring events) are conducted. Choose from:
 - UK (information not in file or the file is missing)
 - Annual (completed once every year or is a one-time event)
 - Staggered (completed with no specific pattern, e.g. years 1, 2, 5 and 7)
 - Semi-annual (completed more than once per year)
 - NA (if monitoring was not required for the project)

- Performance Criteria – assesses specific performance criteria.
Choose from:
 - 0 (no performance criteria or no information available)
 - 1 (qualitative criteria)
 - 2 (quantitative and measurable criteria)
- Contingency Measures – assesses file's contingency measures.
Select:
 - 0 (no contingency measures identified or no information is available)
 - 1 (a standard or generic clause was used in the authorization)
 - 2 (specific, detailed measures were provided)

3.2.6 DFO Monitoring Information Screen

- Site Visit - choose from:
 - Y (if a compliance site visit was completed)
 - N (if there was no record in the file or PATH that a compliance site visit was completed).
- Proponent Compliant With Mitigation – indicates whether the proponent employed the required mitigation. To complete this assessment the auditor must review the monitoring reports. Choose from:
 - Y
 - N
 - UK
 - P
- Project As-built provided – choose from:
 - Y
 - N (if the as-built was not required it is still recorded as No)
 - UK
- Compensation As-built provided – choose from:
 - Y
 - N (if the as-built was not required it is still recorded as No)
 - UK
 - NA (if cash in kind was accepted as compensation, or if no compensation was required).
- Proponent Compliant with Compensation – this is not specific to whether the compensation it is productive or functioning as intended, but whether it was physically built the way/size/place that was proposed. If cash was authorized for the compensation, answer the question based on whether they followed through on their commitment. Choose from:
 - Y
 - N
 - UK
 - P
 - NA (if no compensation was required)

- Proponent Monitoring Criteria Met – choose from
 - Y
 - N
 - UK (when the hard copy file could not be located)
 - P
 - NA (if no reports were required)
 - Reports Up to Date – only consider compensation monitoring reports when answering this question; do not include construction monitoring reports. Choose from:
 - Y
 - N (also use No if the hard copy file could not be located and there was no way of knowing whether the reports were up to date – if the monitoring reports cannot be found, they are not considered up to date. This has implications for DFO file management in addition to proponent compliance with reporting requirements)
 - NA (if no reports were required)
- 3.3 If documents were absent, the assessor was contacted and asked about the location of the documents. If the documents could not be located and there was no other documentation indicating they were received it was assumed those documents were never received.
- 3.4 The status of the file, as identified in PATH, was recorded. If, after reviewing the files, the auditor thought the status was out of date it was noted in the Authorization Audit File Status Tracking Sheet. The assessor was also contacted to confirm that the status should be updated.
- 3.5 All closed files were retained for filing in a central area and any open files were returned to the assessor.
- 3.6 The status of any outstanding Letters of Credit was assessed and if updates were necessary the assessor was contacted to confer on the next course of action.
- 3.7 If an active file was assigned to an assessor who no longer worked in the Area, recommendations were made to the appropriate Team Leader with regard to reassigning the file.