BEFORE THE ENVIRONMENT COURT
I MUA I TE KOOTI TAIAO O AOTEAROA

AT CHRISTCHURCH **KI ŌTAUTAHI**	**ENV-2018-CHC-000036**
IN THE MATTER	of the Resource Management Act 1991
AND	of an appeal under clause 14 of the First Schedule of the Act
BETWEEN	**Director-General of Conservation *Tumuaki Ahurei*** Appellant (ENV-2016-CHC-000036)
AND	**Southland Regional Council** Respondent

Topic B Tranche 1 Evidence (Freshwater Ecology) of Emily Pearl Funnell for the Director-General of Conservation *Tumuaki Ahurei,* Appellant

Dated 20 December 2021

Department of Conservation Te Papa Atawhai
Planning, Permissions and Land
RMA Shared Services
Private Bag 4715
Christchurch 8140
Phone Waea: 03 371 3700
Solicitor Roia: Pene Williams

Introduction

1. My full name is Emily Pearl Funnell. My experience and qualifications are set out at paragraphs 3 to 7 of my evidence in chief dated 1 March 2019.

2. I have been involved in the proposed Southland Water and Land Plan (pSWLP) process in the following ways:
   a. Evidence in Chief as a Section 274 Party in Support (Topic A hearing) dated 1 March 2019, and associated Environment Court Hearing – Topic A;
   b. Expert Conferencing – Water Quality and Ecology (Rivers and Wetlands) 7-9 May 2019 and resulting Joint Witness Statement;
   c. Statement of Rebuttal Evidence as a Section 274 Party, dated 20 May 2019;
   d. Expert Conferencing and resulting Joint Witness Statements dated 16 October 2019, and 22 November 2019;
   e. Environment Court facilitated mediation on Topic B4; and
   f. Will say statement dated 29 October 2021.

3. I have been asked by the Director-General of Conservation *Tumuaki Ahurei* (D-G, Director-General) to provide evidence in relation to the outstanding appeal Topic B matters on the proposed Southland Water and Land Plan (pSWLP).

Code of Conduct

4. I confirm that I have read the code of conduct for expert witnesses as contained in section 7.1 of the Environment Court's Practice Note 2014. I have complied with the practice note when preparing my written statement of evidence and will do so when I give oral evidence before the Court.

5. The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in the evidence to follow.

6. Unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope

7. This evidence is confined to the outstanding proposed Southland Water and Land Plan (pSWLP) Director-General's appeal matter on Rule 78 – Weed and sediment removal for drainage maintenance.

8. In preparing this evidence, the documents I have read and considered since my evidence in chief dated 1 March 2019 are:

   a. Dunn, Dr N., 2021, "Memo: Assessment of Southland Regional Council proposed Southland Water and Land Plan – Rule 78 weed and sediment removal rule testing", dated 18 June 2021, internal memorandum, Department of Conservation (attached as Appendix 1 to my Will Say Statement, dated 29 October 2021).

   b. Greer, Dr M., 2021 "Proposed Southland Water and Land Plan: Technical advice for mediation" dated 23 April 2021.

   c. Expert Conferencing – Ecology 1 December 2021 and resulting Joint Witness Statement.

Effects of weed and sediment removal on non-diadromous galaxias

9. Paragraphs 41 to 49 of my Evidence in Chief dated 1 March 2019 give an overview of the freshwater fish values of Southland. I note the presence of five threatened non-diadromous galaxias within the Southland region (Table 1). Pomahaka galaxias and Clutha flathead galaxias have populations on the edges of the Southland region. However, other species such as Southern flathead galaxias and Gollum galaxias are widespread across Southland.

10. In the Ecology JWS (December 2021), adverse effects of drainage management on freshwater species are listed. In addition, the memorandum from Dr Greer details several key threats on freshwater species. He goes on to conclude that the activity is destructive, and the adverse effects on threatened species and non-diadromous galaxias is likely to be significant.

11. I note that the term "non-migratory galaxias" in the Director-General's appeal[1] should be replaced with the term "non-diadromous galaxias". This is because the term non-diadromous galaxias is more technically appropriate to describe the species that the D-G sought to include in Rule 78, as "non-diadromous" refers to fish that do not migrate between freshwater and marine environments,

[1] Notice of Appeal dated 17 May 2018, paragraph 8.1

completing their entire life-history in freshwater. “Diadromous” refers to fish that have a regular life-history phase of migration between freshwater and the marine environment.

12. The non-diadromous galaxias species found in Southland are all classified as threatened species. Whilst some species are widespread across Southland, their populations have undergone range reduction and fragmentation (reduced to often small pockets of habitat). This is a result of a combination of habitat loss and predation by introduced species e.g., trout.

13. The habitat occupied by these species include small tertiary braids and weedy backwaters of larger rivers, wetlands, spring-fed creeks, and farm ditches. They also use an array of refugia including cobbles and gravels, and overhanging banks and vegetation.

14. Weed and sediment removal can have adverse effects on non-diadromous galaxias by:
    - loss of habitat (i.e., removal of gravels, removal of vegetation, altered habitat structure),
    - stranding of fish, and
    - crushing or removal of eggs.

    Non-diadromous galaxias rely on gravels and vegetation for cover and for spawning habitat. Continuation of weed and sediment removal within non-diadromous galaxias habitat could result in localised species extinctions.

15. The memorandum from Dr Nicholas Dunn provides an analysis of the extent of co-incidence of non-diadromous galaxias habitat that is potentially affected by Rule 78 (attached as Attachment 1, the Dunn analysis). The approach taken for the Dunn analysis was to compare mapped habitats created in GIS, with water courses managed by Southland Regional Council as drains, and water courses identified on Land Information New Zealand (LINZ) Topo50 maps as drains.

16. From the Dunn analysis, a total of 43 (30%) of Council managed drains were found to coincide with mapped non-diadromous galaxias habitat. There was coincidence of Gollum galaxias (*Galaxias gollumoides*) and southern flathead galaxias (*Galaxias “southern”*) with Council managed drains, but not for alpine galaxias (*Galaxias affinis paucispondylus “Southland”*), Clutha flathead galaxias (*Galaxias “species D”*) or Pomahaka galaxias (*Galaxias “Pomahaka”*).

17. In addition, 9% of LINZ Topo50 identified drains were found to coincide with mapped non-diadromous freshwater fish habitats. Only alpine galaxias (Southland) didn't have coincidence with LINZ Topo50 identified drains. However, the LINZ Topo50 drain layer is likely an underrepresentation of the water courses subjected to weed and sediment removal (an overlay of the LINZ Topo50 drain layer with topographic maps reveals additional straightened water courses (illustrated in Dr Dunn's memo. Attachment 1)).

18. This analysis demonstrates the risk of the weed and sediment removal to the threatened non-diadromous galaxias populations in Southland.

19. The conditions in the pSWLP Council decision version of '*Rule 78 – weed and sediment removal for drainage maintenance*' fail to protect native fish values in waterways. Where threatened fish are found, they can be physically removed, their habitat altered, and spawning disrupted.

20. Enduring changes to habitat of threatened non-diadromous galaxias should be avoided. I consider that their habitat (identified in a schedule) requires a higher level of protection. In these habitats, I consider the activity should be discretionary.

Rule 78 – Weed and sediment removal for drainage maintenance (Council relief version dated 11 November 2021)

21. The Council relief version of Rule 78 seeks to address the effects of the activity on non-diadromous galaxias through the provision of mapping of their habitat and a description within the rule to describe the size and extent of the sediment that can be removed ("*95% of the sediment removed shall have a grain size of less than 2mm*"). Fine sediment includes mud, silt and sand less than 2mm in diameter, while gravel includes particles between 2mm and 64 mm (Wentworth, 1922).

22. The Council's relief version of Rule 78 will reduce the amount of gravel being removed with weed and sediment removal and protect gravel habitat for freshwater fish. This will afford a higher level of protection for non-diadromous galaxias than the permitted activity rule currently provides. I support the relief now being sought by Council.

Emily Pearl Funnell
20 December 2021

Attachment 1:

Memorandum from Dr Nicholas Dunn, dated 18 June 2021

Department of Conservation
Te Papa Atawbai

Date: 18 June 2021

To: Linda Kirk – RMA Planner, RMA Team, Operations Group

Amelia Ching – RMA Planner, RMA Team, Operations Group

Pene Williams – Lawyer, Legal Services, Corporate Services Group

Emily Funnell – Freshwater Technical Advisor, Aquatic Unit, Biodiversity Group

CC: Alexander Macdonald – acting Freshwater Manager, Aquatic Unit, Biodiversity Group

From: Nicholas Dunn – Freshwater Science Advisor, Aquatic Unit, Biodiversity Group

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Memo: Assessment of Southland Regional Council proposed Southland Water and Land Plan – Rule 78 weed and sediment removal rule testing

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The purpose of this memo is to provide an assessment of the Southland Regional Council proposed Southland Water and Land Plan – Rule 78 weed and sediment removal rule, in the sense of testing of the extent of co-incidence of native freshwater fish habitat potentially affected by the rule.

Two approaches have been taken:

Approach 1 - Coincidence of freshwater fish and freshwater invertebrate taonga species recognised in Appendix M of the plan with water courses managed by Southland Regional Council as drains, and water courses identified on Land Information New Zealand (LINZ) Topo50 maps as drains. In essence this list includes all native freshwater fish occurring within the Southland Regional Council boundary. Three freshwater fish species present in Southland were omitted from this Appendix, but have been mapped in this assessment (Appendix 1 – high resolution files in DOC-6695243) for completeness, being

- *Aldrichetta forsteri* - Yelloweye mullet: Not Threatened
- *Forsterygion nigripenne* - Estuarine triplefin: Not Threatened
- *Galaxias* species D - Clutha flathead galaxias (Clutha River): Nationally Critical

Approach 2 – Coincidence of threatened non-diadromous galaxias (Table 1) for which known distributions have been created in GIS with water courses managed by Southland Regional Council as drains, and water courses identified on Land Information New Zealand (LINZ) Topo50 maps as drains.

The following datasets were used in the assessment:

- New Zealand Freshwater Fish Database (NZFFD; https://nzffdms.niwa.co.nz) as at 8 June 2021.
- Known distributions of non-diadromous freshwater fish based on the methods of Dunn (2017) as at 8 June 2021.
- ES_DrainageNetwork shape file provided by Southland Regional Council to DOC on 4 June 2021.
- Southland_Topo50_drains shape file provided by Southland Regional Council to DOC on 4 June 2021.
- World_Imagery (http://services.arcgisonline.com/arcgis/services) as at 8 June 2021.
- Topo50 from LINZ Data Service (https://www.linz.govt.nz/data/linz-data-service).

Table 1. Freshwater fish taxa, their conservation status (Dunn et al. 2018) and distribution in Southland, included in this assessment.

Species	Common name	Conservation status	Catchments	Number of habitat fragments
*Galaxias "*species D"	Clutha flathead galaxias (Clutha River)	Nationally Critical	Taieri, Tokomairiro, Clutha, Catlins, Purakaunui, Tahakopa, Waikawa rivers, Karoro, Longbeach creeks	2
Galaxias gollumoides	Gollum galaxias	Nationally Vulnerable	Clutha, Catlins, Purakaunui, Tahakopa, Waikawa Tokanui, Mataura, Waihopai, Oreti, Freshwater, Robertson, Aparima, Waiau rivers, Titiroa Stream, Kowhai Creek	185
*Galaxias "*Pomahaka"	Pomahaka galaxias (Southland, Otago)	Nationally Vulnerable	Clutha River	9
*Galaxias "*southern"	Southern flathead galaxias (Southland, Otago)	Nationally Vulnerable	Clutha, Mataura, Oreti, Freshwater, Rakeahua, Aparima, Waiau rivers	85
Galaxias affinis *paucispondylus* "Southland"	Alpine galaxias (Southland)	Nationally Vulnerable	Clutha, Mataura, Oreti, Waiau rivers	8

Assessments were made by visually comparing fish distributions and mapped drains. The following categories of co-incidence were recognised:

Southland Regional Council managed drains:

1. No co-incidence of a Southland Regional Council (SRC) managed drain and a known fish distribution.
2. Partial co-incidence of a SRC managed drain and a known fish distribution, including confluent tributaries.
3. Complete co-incidence of a SRC managed drain and a known fish distribution.

4. No co-incidence of a SRC managed drain when a known fish distribution is extended by a buffer of 1 km (this allows for fish presence in a drain beyond the known distribution, and thus giving effect to the caveats identified by Dunn (2017)).
5. Partial co-incidence of a SRC managed drain and a buffered known fish distribution, including confluent tributaries.
6. Complete co-incidence of a SRC managed drain and a buffered known fish distribution.

LINZ Topo50 identified drains:

7. No co-incidence of a Topo50 identified drain when a known fish distribution is extended by a buffer of 1 km (this allows for fish presence in a drain beyond the known distribution, and thus giving effect to the caveats identified by Dunn (2017)).
8. Partial co-incidence of a Topo50 identified drain and a buffered known fish distribution, including confluent tributaries.
9. Complete co-incidence of a Topo50 identified drain and a buffered known fish distribution.

10. No co-incidence of a drain identified on a LINZ Topo50 map and a known fish distribution.
11. Partial co-incidence of a Topo50 identified drain and a known fish distribution, including confluent tributaries.
12. Complete co-incidence of a Topo50 identified drain and a known fish distribution.

A total of 4 summary GIS files were created during the assessment:

- Non-diadromous freshwater fish habitats - derived from DOC data
- Buffered non-diadromous freshwater fish habitats - derived from DOC data
- SRC drainage network – derived from Southland Regional Council data
- LINZ Southland Topo50 drains – derived from LINZ data

These files are located in the zip folder: SRC pSWLP Rule 78 non-diadromous galaxias and drain coincidence assessment 170621 (DOC-6695243).

Each file was appended with columns denoting the coincidence categories given above. An individual row identifier was appended to the SRC drainage network.

Interpretation of the buffered reach

A 1 km buffer was applied to mapped fish habitats. This was used to assess whether drains occurred within 1 km upstream or downstream of a mapped habitat on the same waterway. Interpretation was required where the buffer extending laterally from a waterway incorporated a drain, and as to whether that drain could be considered habitat for that species (Figure 1; based on the authors knowledge of the species habitat preferences and/or locations in question), and whether the drain directly entered the focal waterway as a tributary.

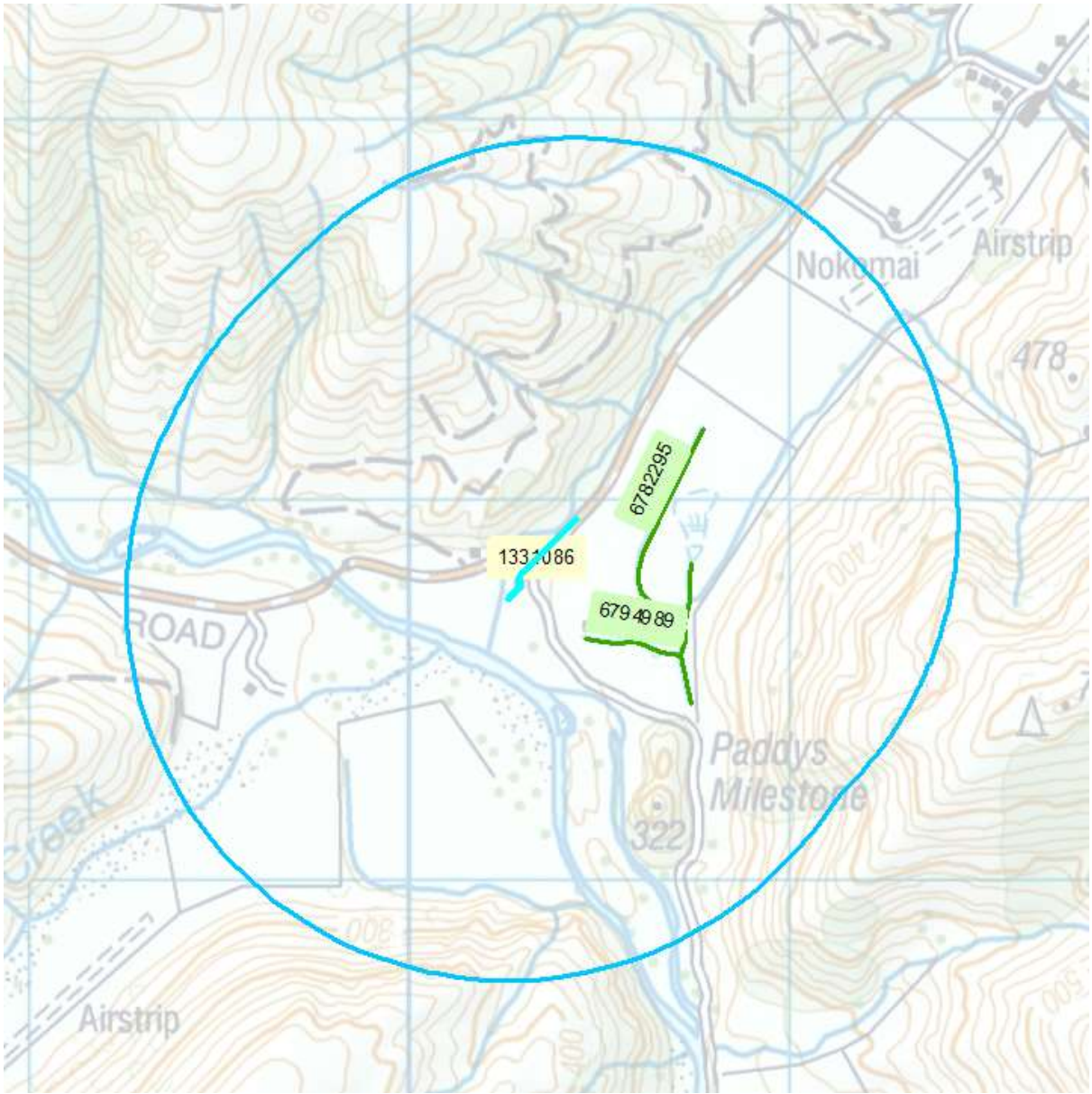


Figure 1. Nokomai River tributary, *Galaxias* "southern" habitat, an example of mapped habitat and drains in close proximity but on different water courses – drain management is not considered to affect mapped habitat for this species at this location.

Identification of drains

An issue was identified that means the amount of water course identified as drains is an underrepresentation of the actual situation on the ground, arising where only a subset of straightened watercourses that are likely subjected to weed and sediment removal have been identified on the LINZ Topo50 drain layer. This situation is illustrated in Figures 2 and 3. At present the extent of the under-representation is unknown. This is a serious planning issue and needs to be resolved before further assessments are undertaken, i.e. the scope of habitats to which the proposed rule will apply needs to be agreed.

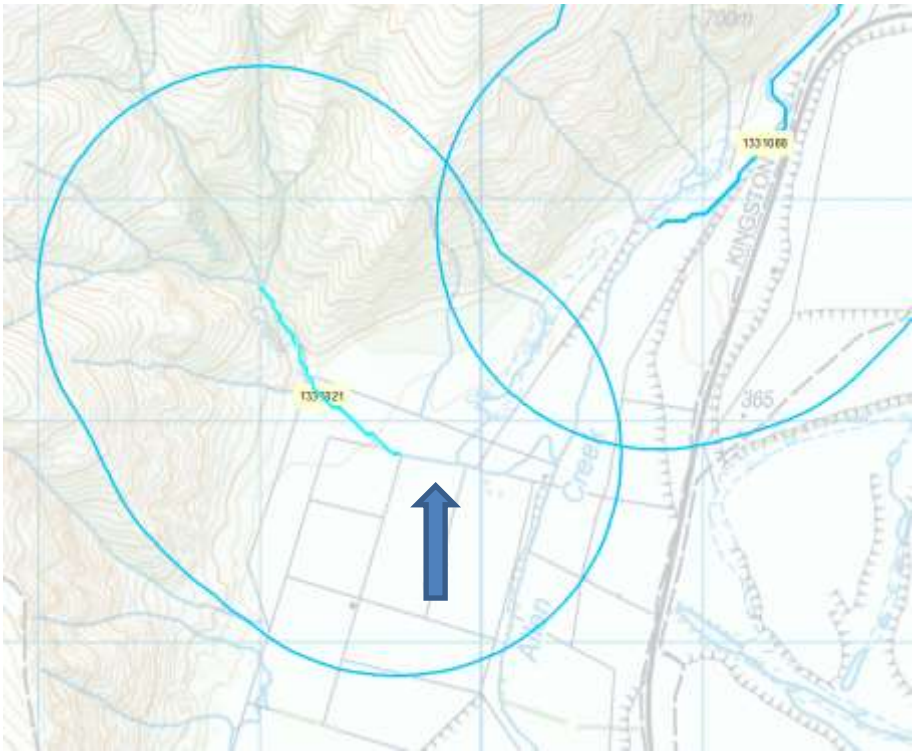


Figure 2. Bushy Creek near Fairlight identified here as *Galaxias* "southern" habitat in its mid reaches, with a straightened lower reach (arrowed) which is not identified as a drain.

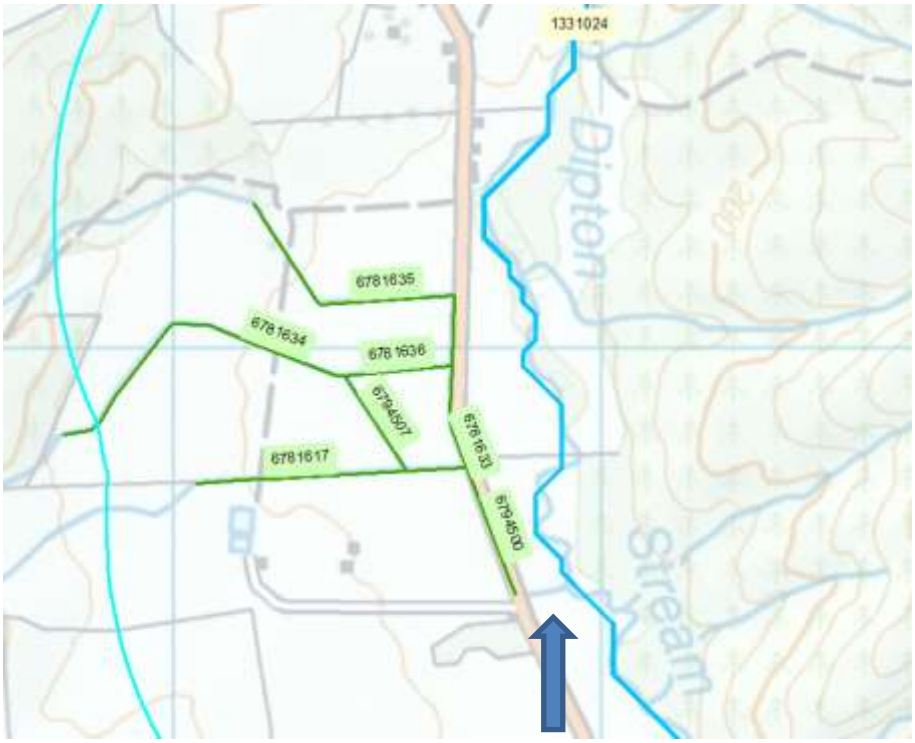


Figure 3. Dipton Stream tributary identified here as confluent with *Galaxias* "southern" habitat. Upper reaches have been identified as drains, but not the downstream reach (arrowed) entering Dipton Stream.

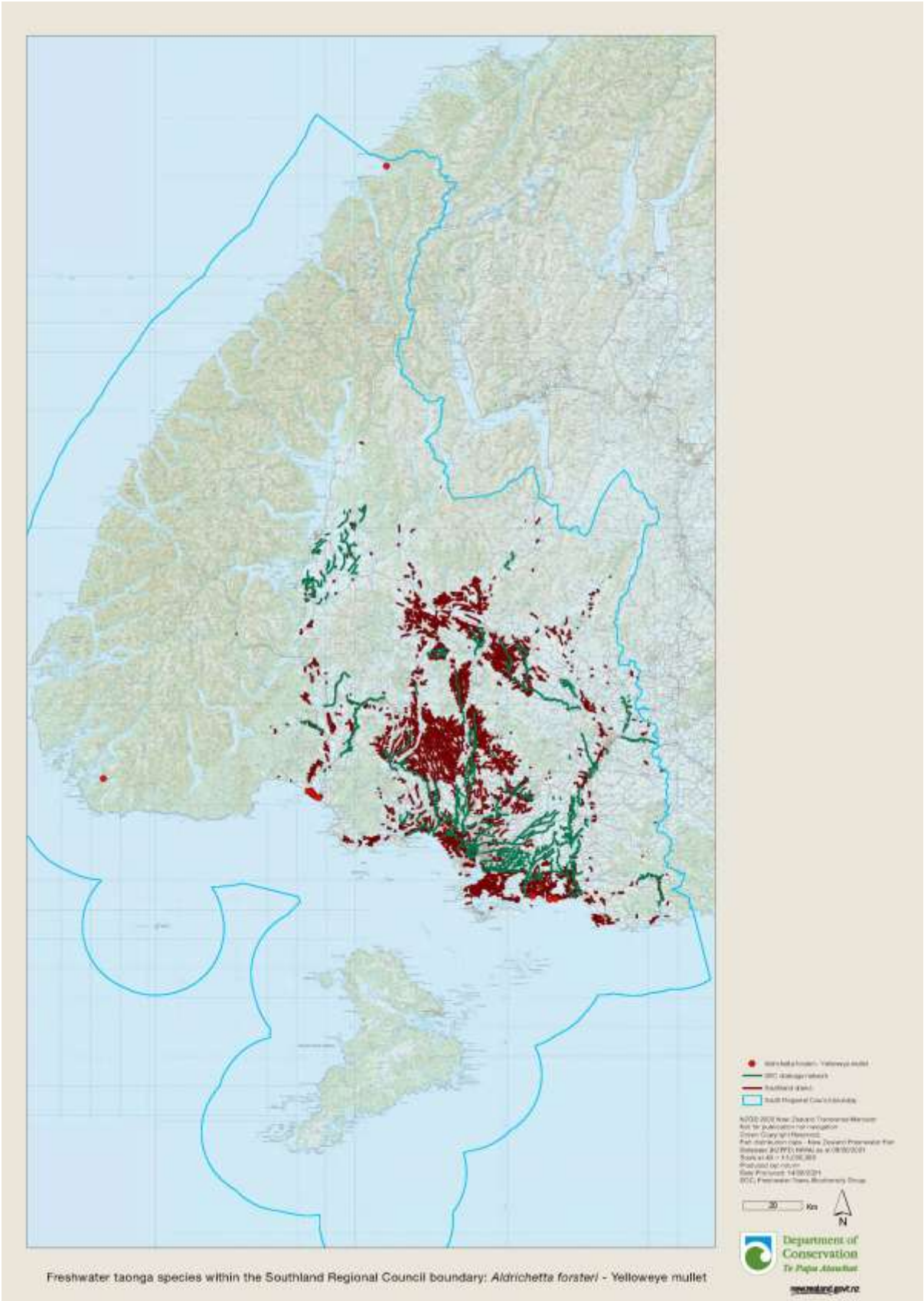
Findings

The assessment undertaken in Approach 2 should be considered as interim until the scope of which water courses and species are included in the rule are resolved.

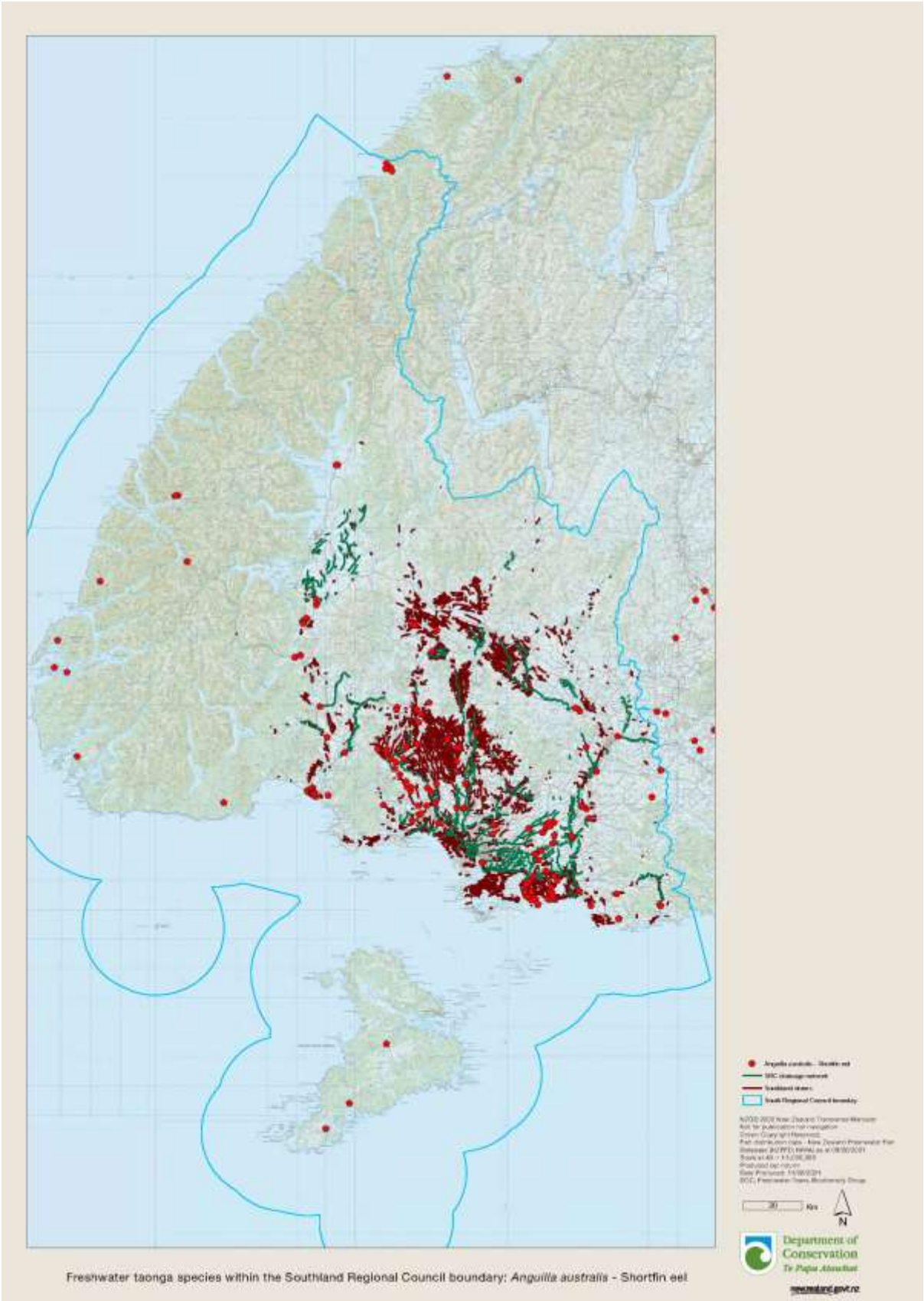
Based on the assessment in Approach 2, the following was found:

- A total of 43 (30 %) of Southland Regional Council managed drains were found to coincide with mapped non-diadromous freshwater fish habitats (Appendix 2 - high resolution file in DOC-6695243)
- There was coincidence of *Galaxias gollumoides* and *Galaxias* "southern" with Southland Regional Council managed drains, but not for *Galaxias* affinis *paucispondylus* "Southland", *Galaxias* "species D" or *Galaxias* "Pomahaka"
- A total of 662 (9 %) of LINZ Topo50 identified drains were found to coincide with mapped non-diadromous freshwater fish habitats (Appendix 3 - high resolution file in DOC-6695243))
- There was coincidence of all taxa with LINZ Topo50 identified drains except for *Galaxias* affinis *paucispondylus* "Southland"
- Council managed drains extended beyond the extent of known habitats indicating the large extent of drains and the small fragmented nature of fish habitats

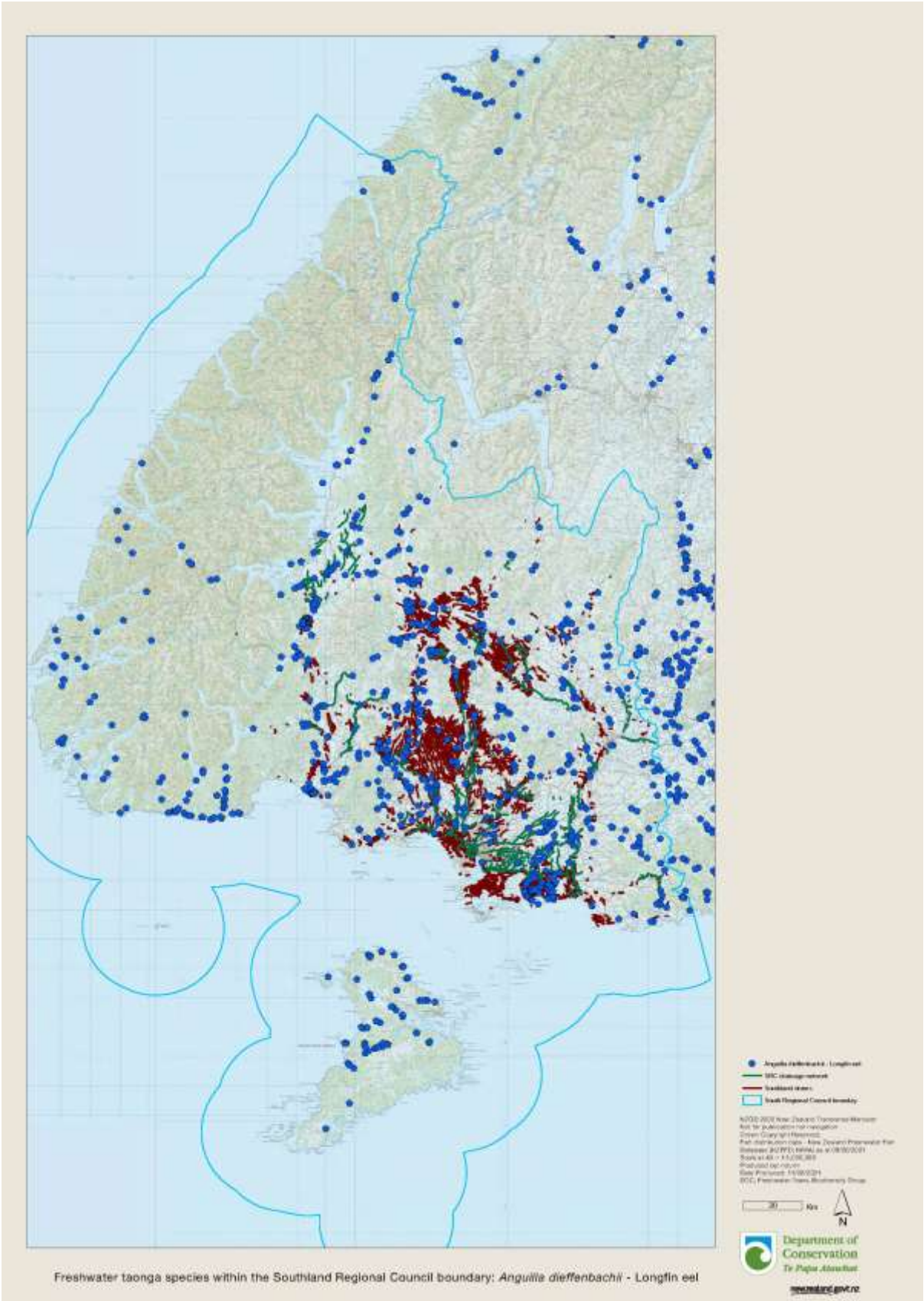
Appendix 1. Approach 1 Maps



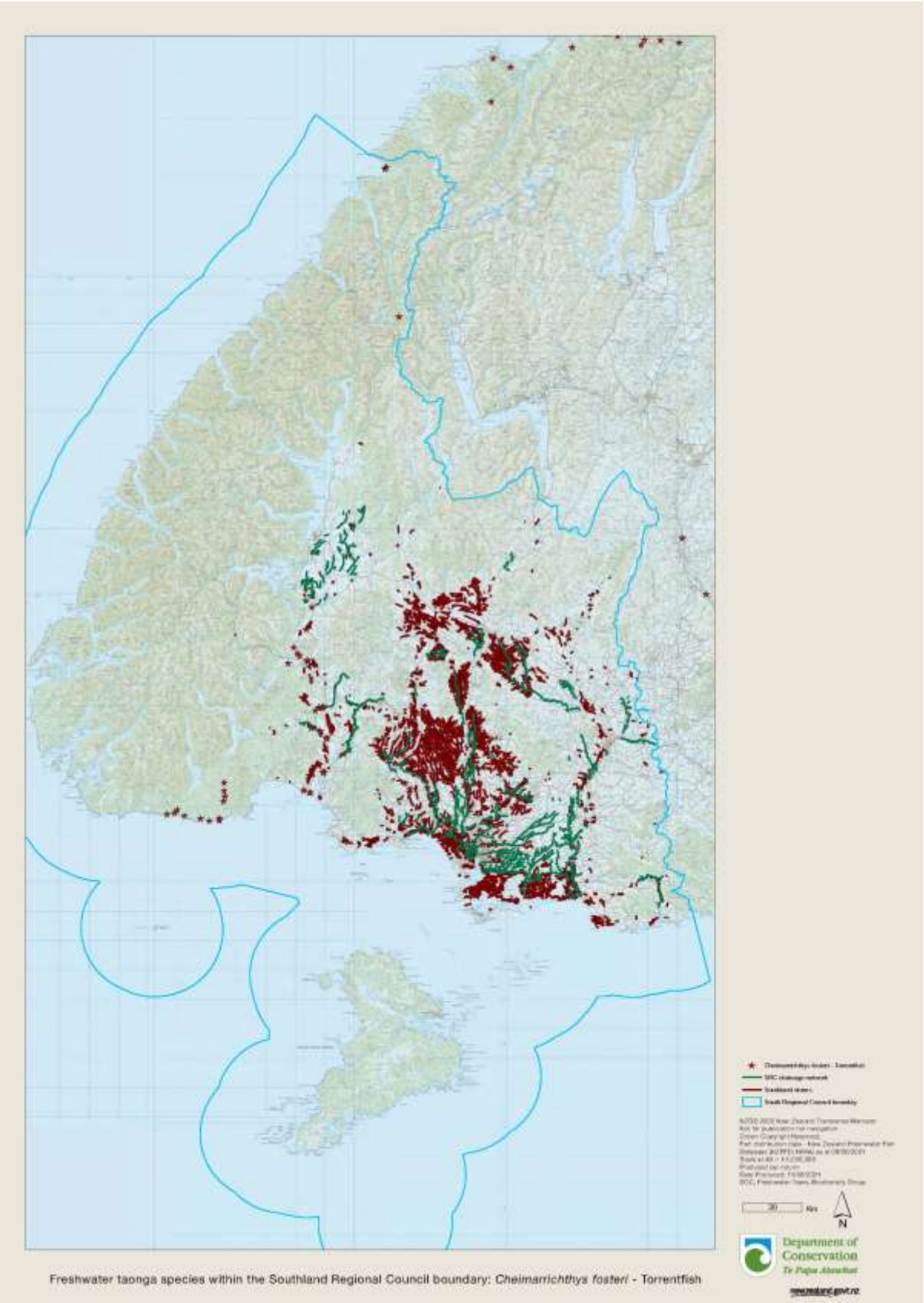
Freshwater taonga species within the Southland Regional Council boundary: *Aldrichetta forsteri* - Yelloweye mullet



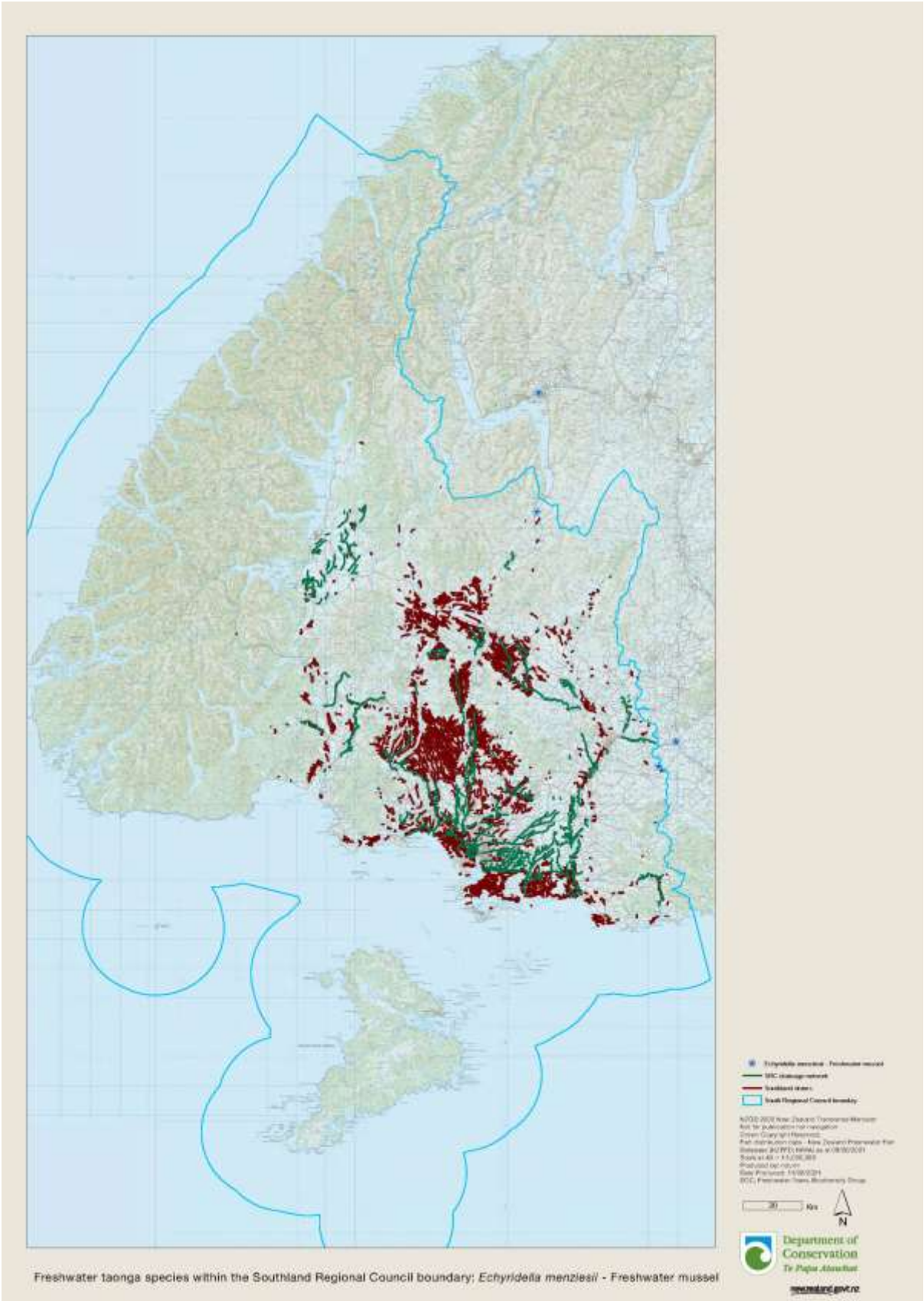
Freshwater taonga species within the Southland Regional Council boundary: *Anguilla australis* - Shortfin eel



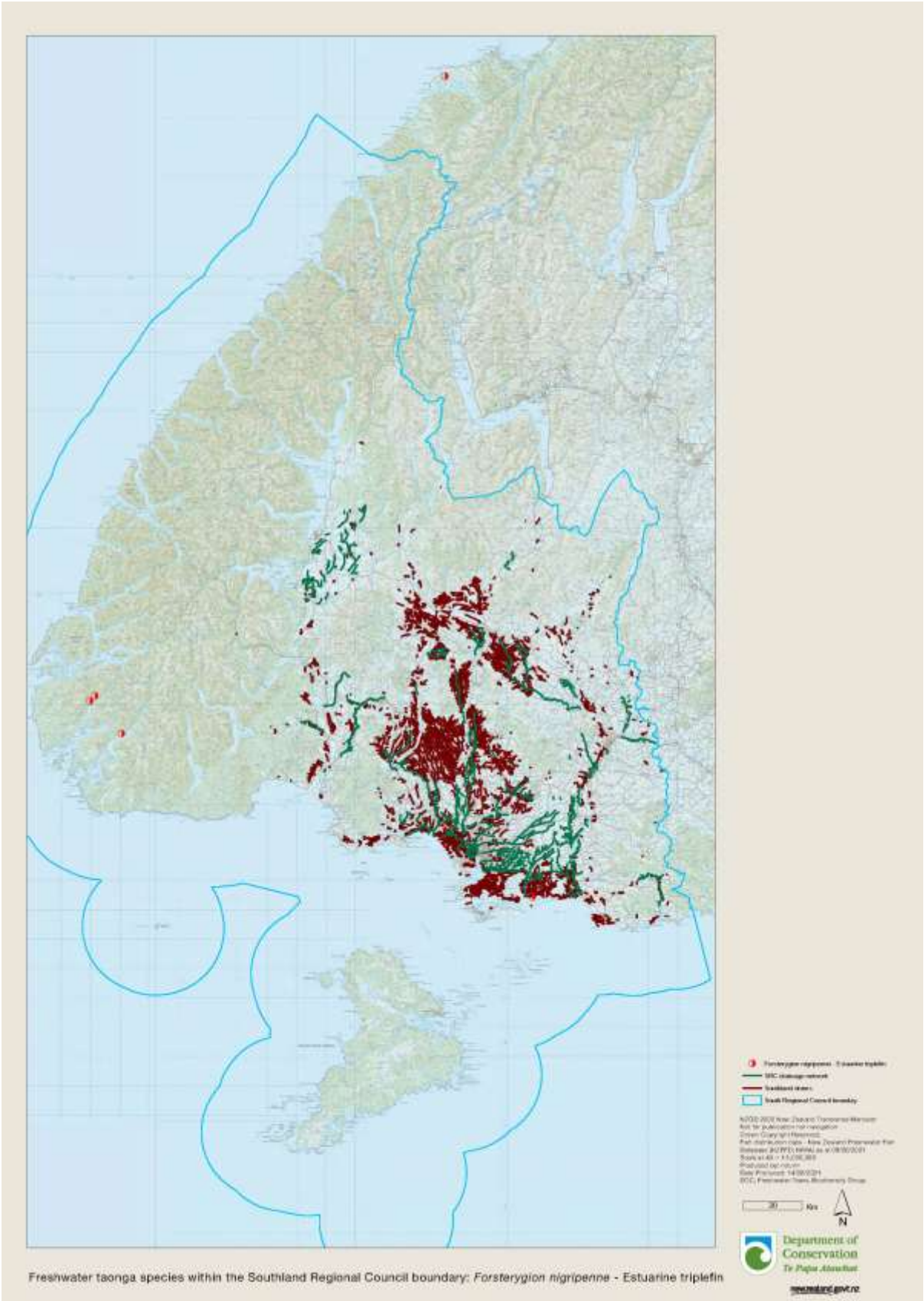
Freshwater taonga species within the Southland Regional Council boundary: *Anguilla dieffenbachii* - Longfin eel



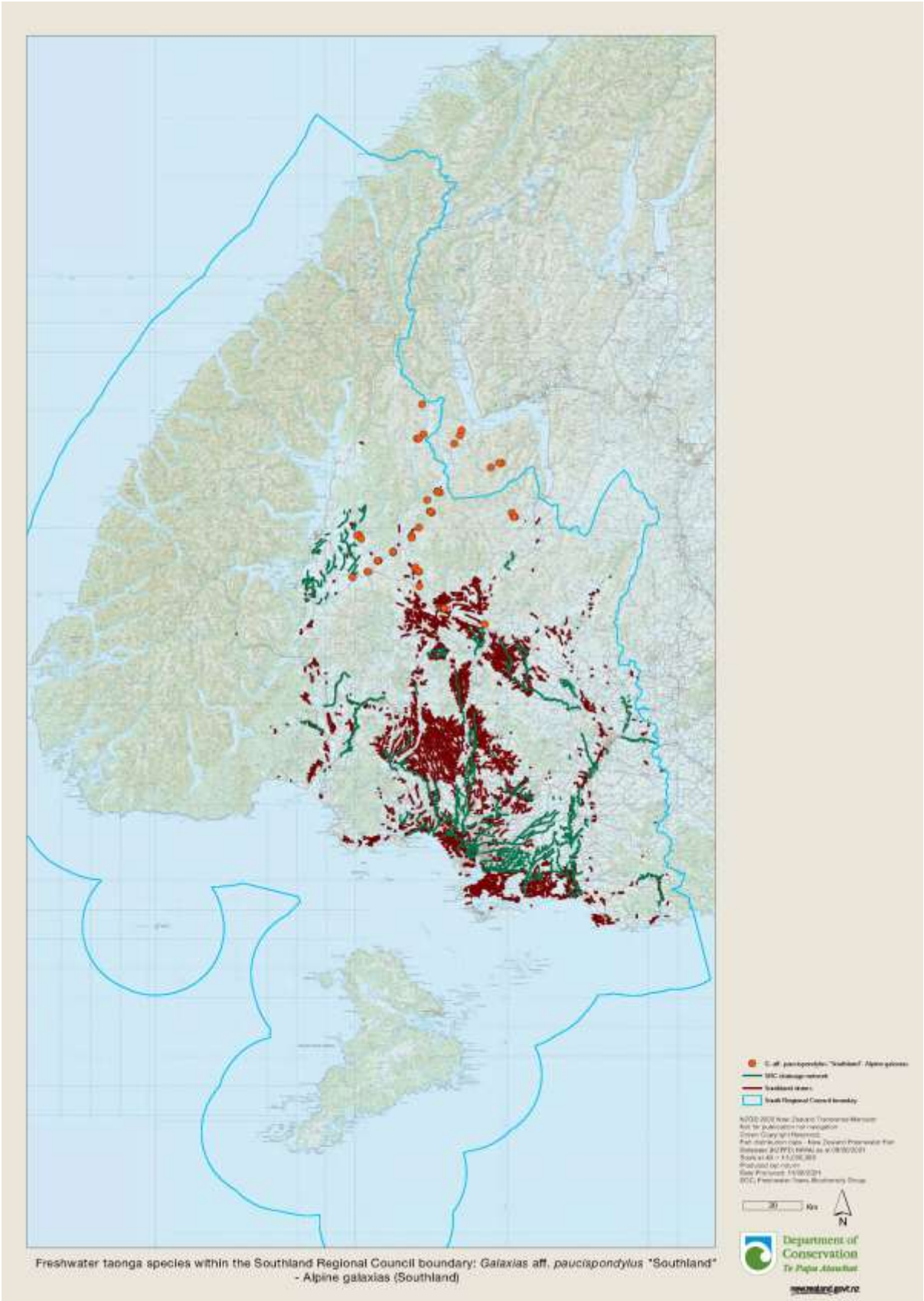
Freshwater taonga species within the Southland Regional Council boundary: *Cheimarrichthys fosteri* - Torrentfish



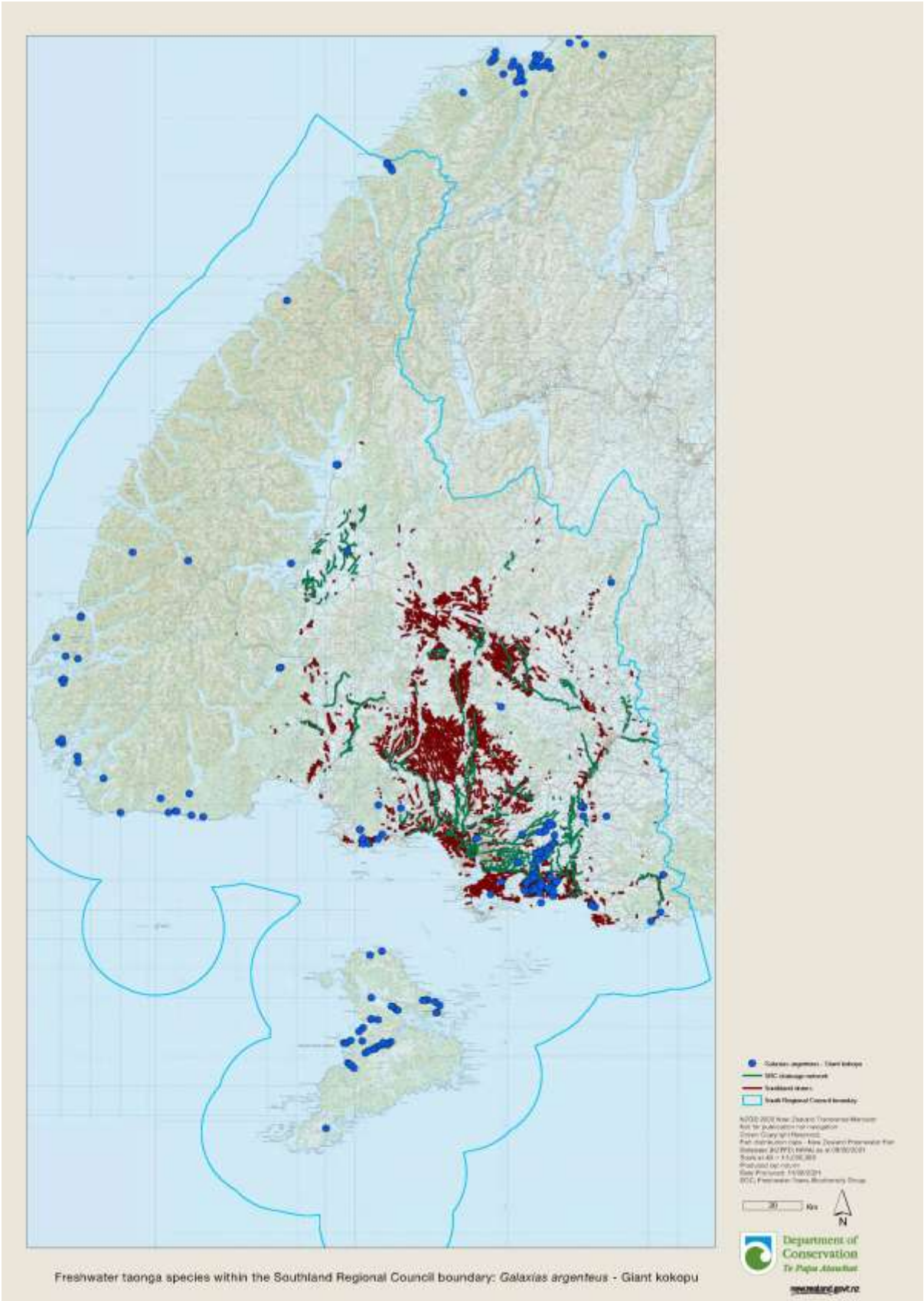
Freshwater taonga species within the Southland Regional Council boundary; *Echyridella menziesii* - Freshwater mussel



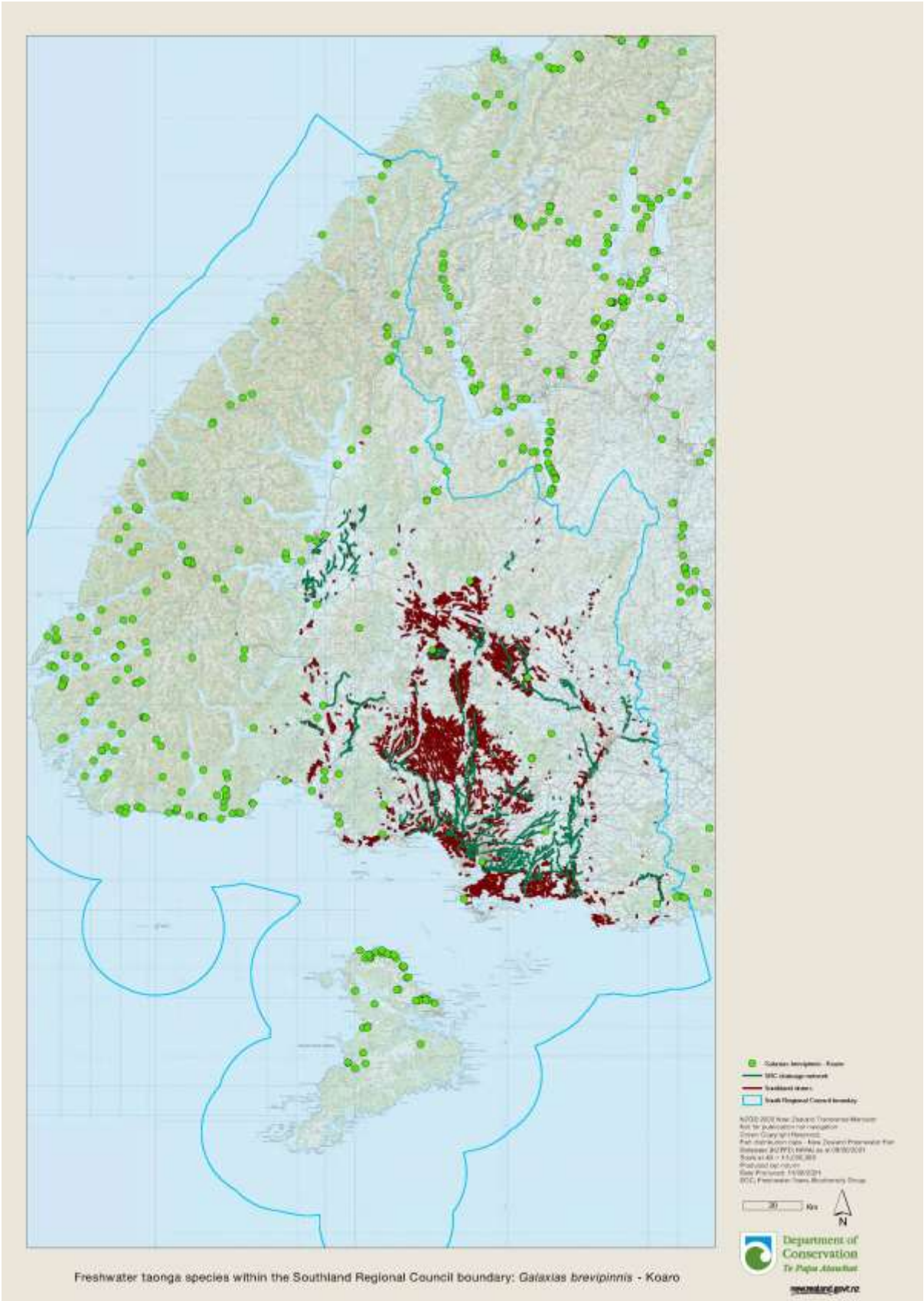
Freshwater taonga species within the Southland Regional Council boundary: *Forsterygion nigripenne* - Estuarine triplefin



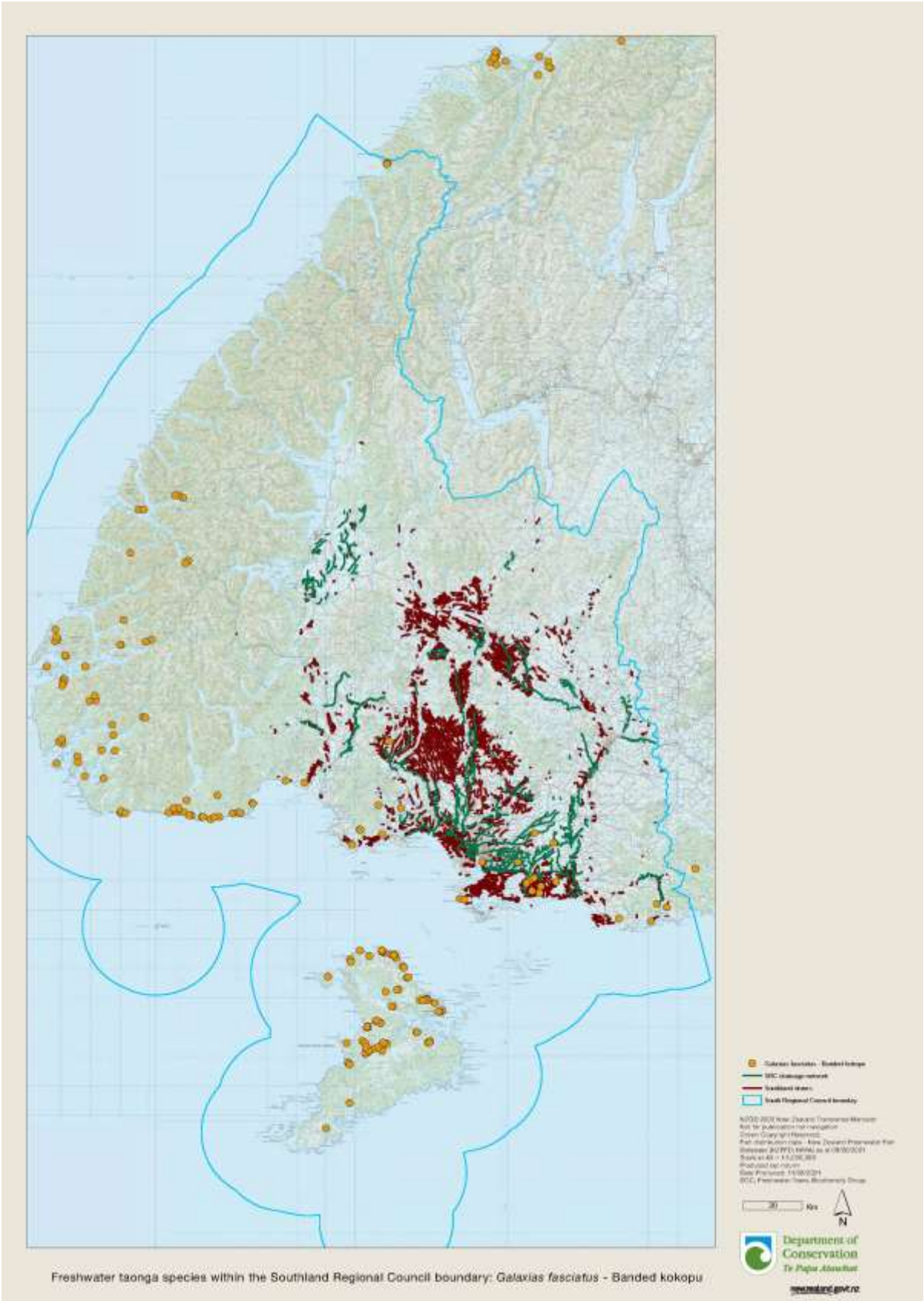
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias* aff. *paucispondylus* "Southland" - Alpine galaxias (Southland)



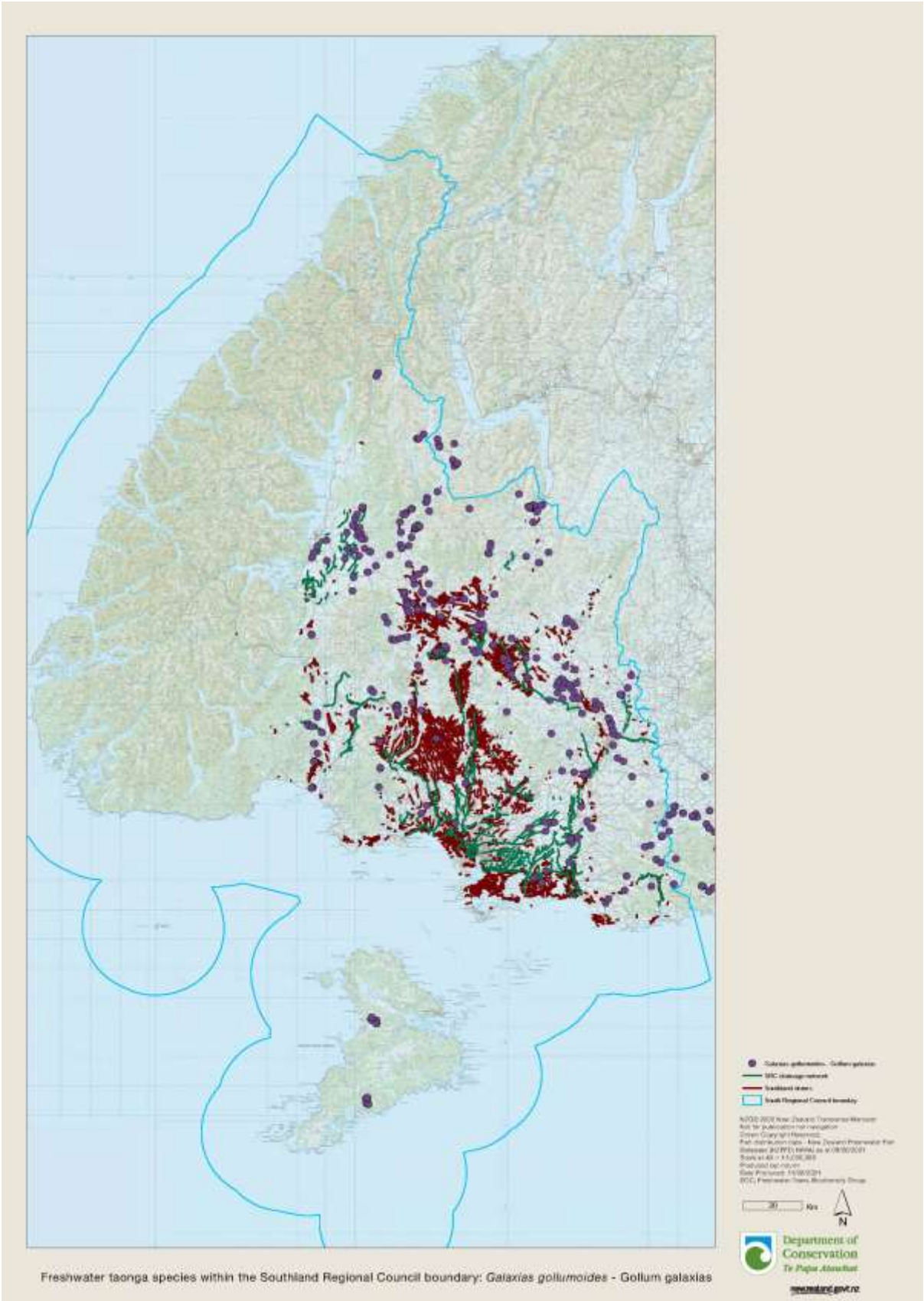
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias argenteus* - Giant kokopu



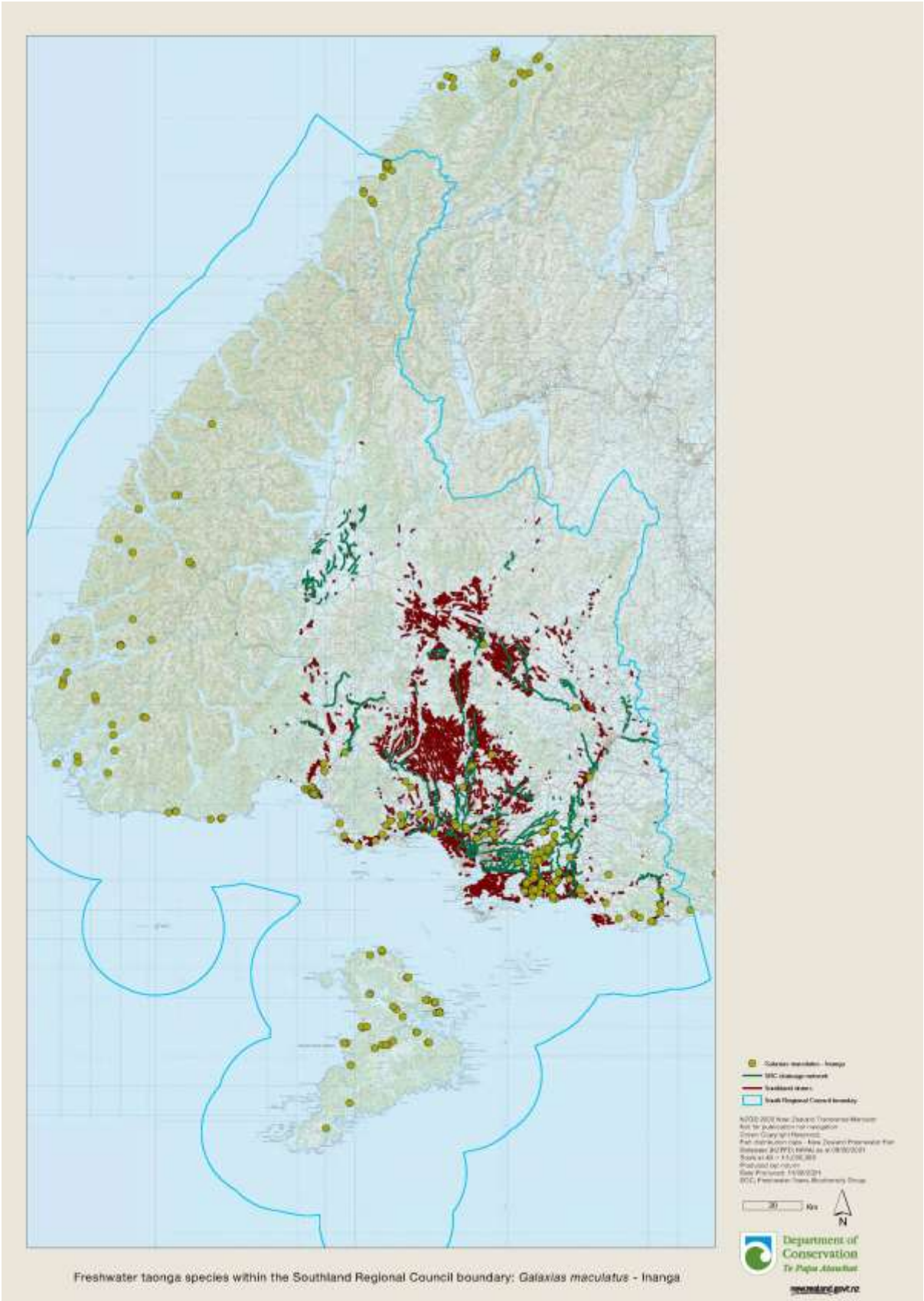
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias brevipinnis* - Koaro



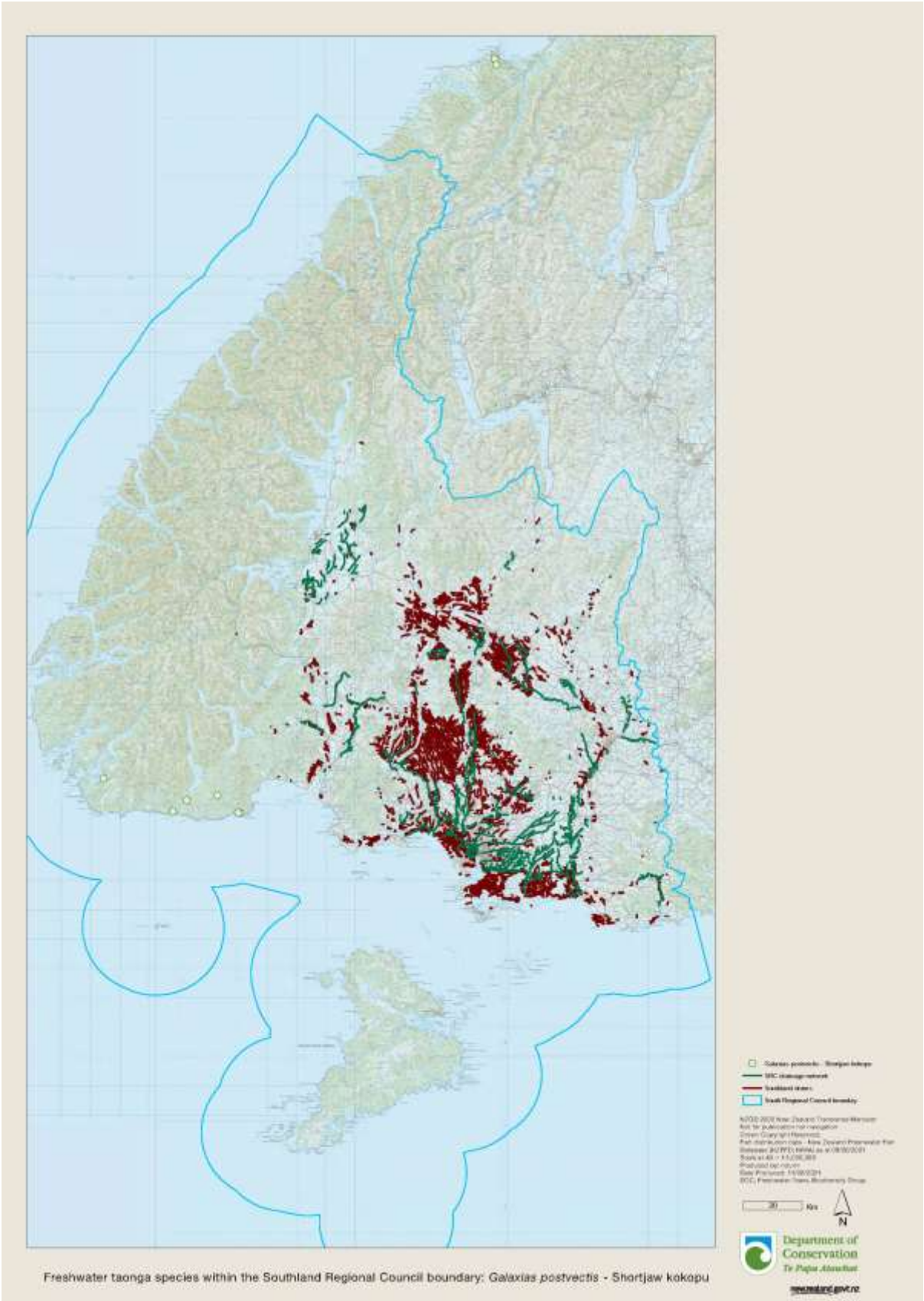
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias fasciatus* - Banded kokopu



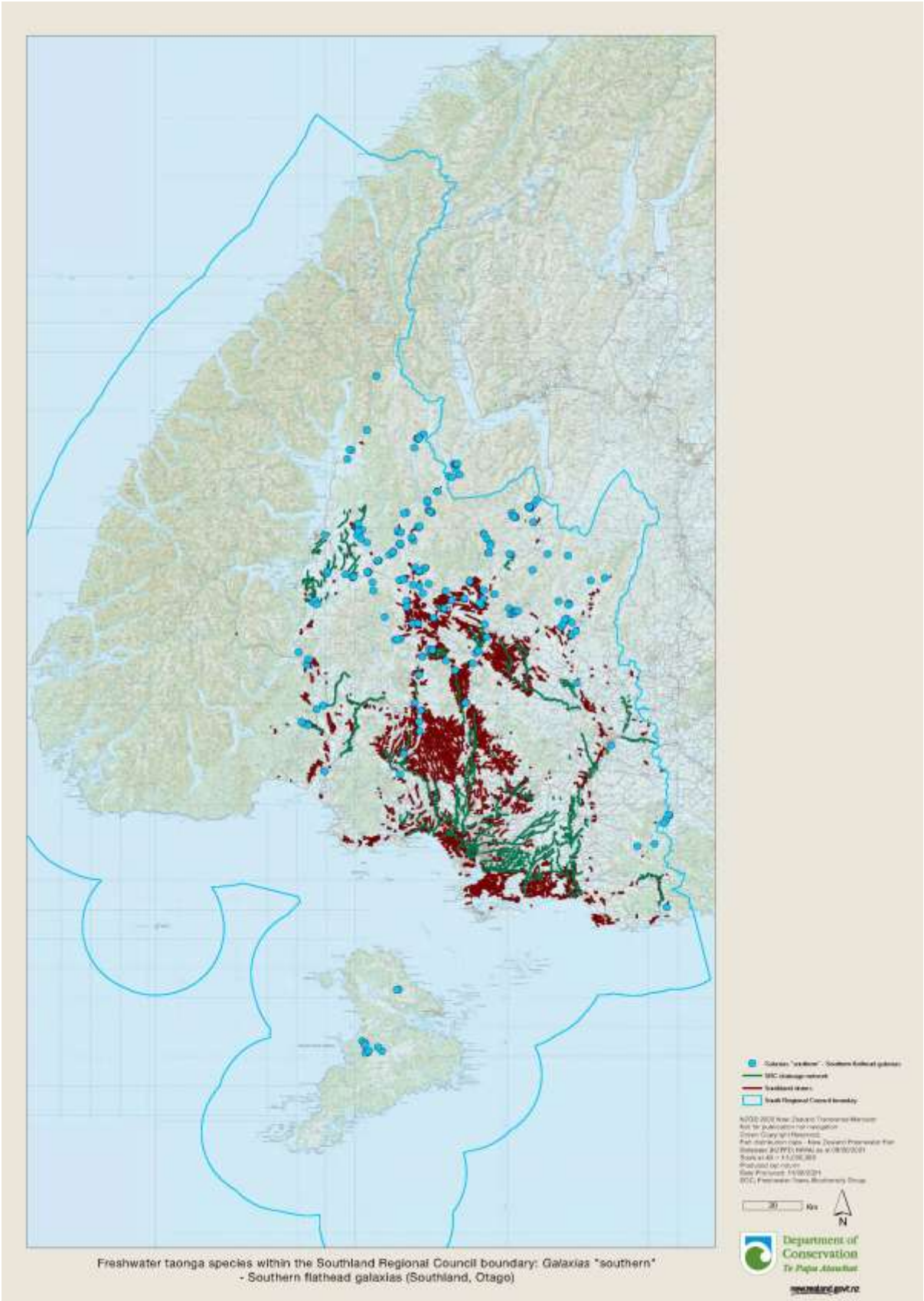
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias gollumoides* - Gollum galaxias



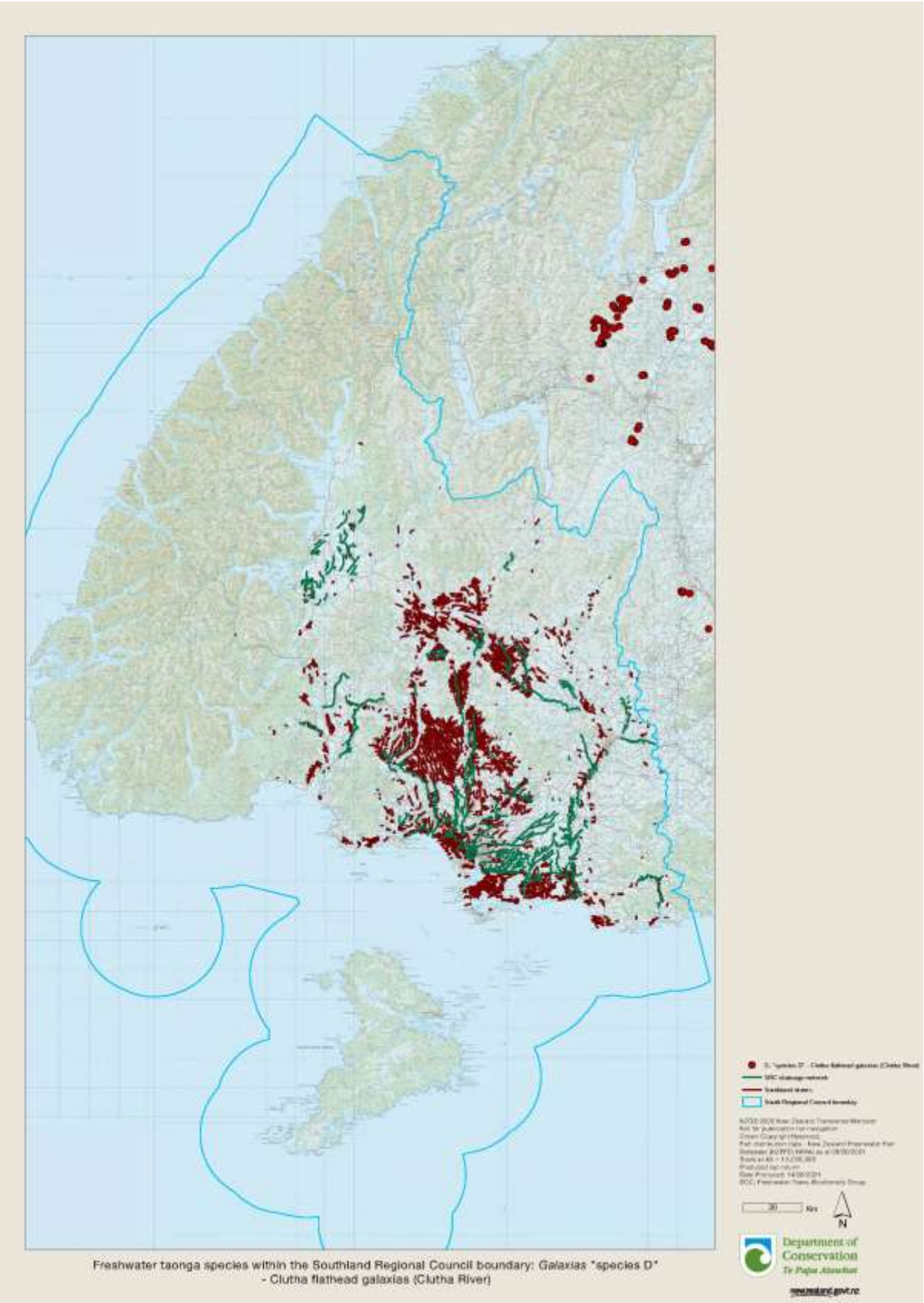
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias maculatus* - Inanga



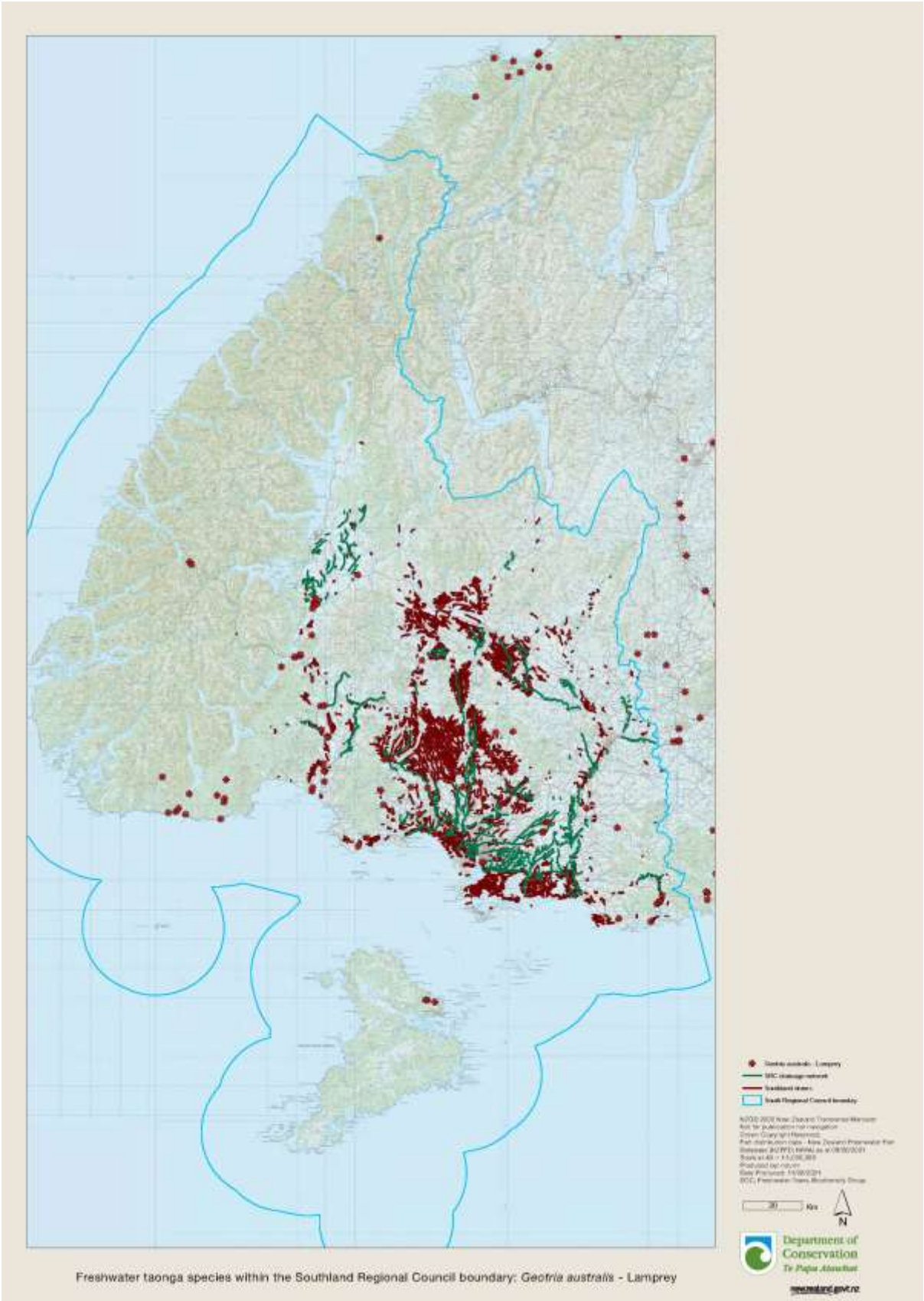
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias postvectis* - Shortjaw kokopu



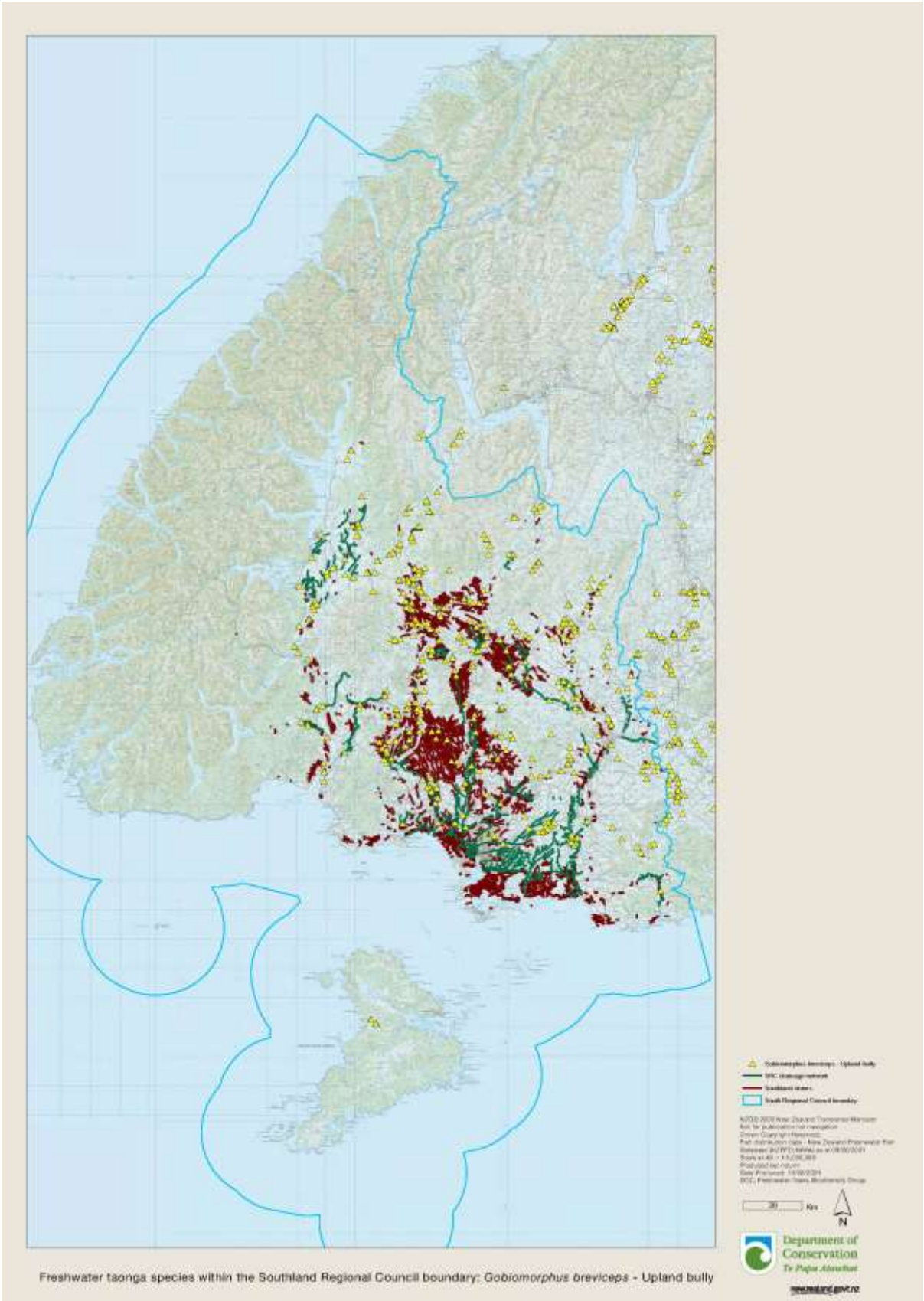
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias* "southern" - Southern flathead galaxias (Southland, Otago)



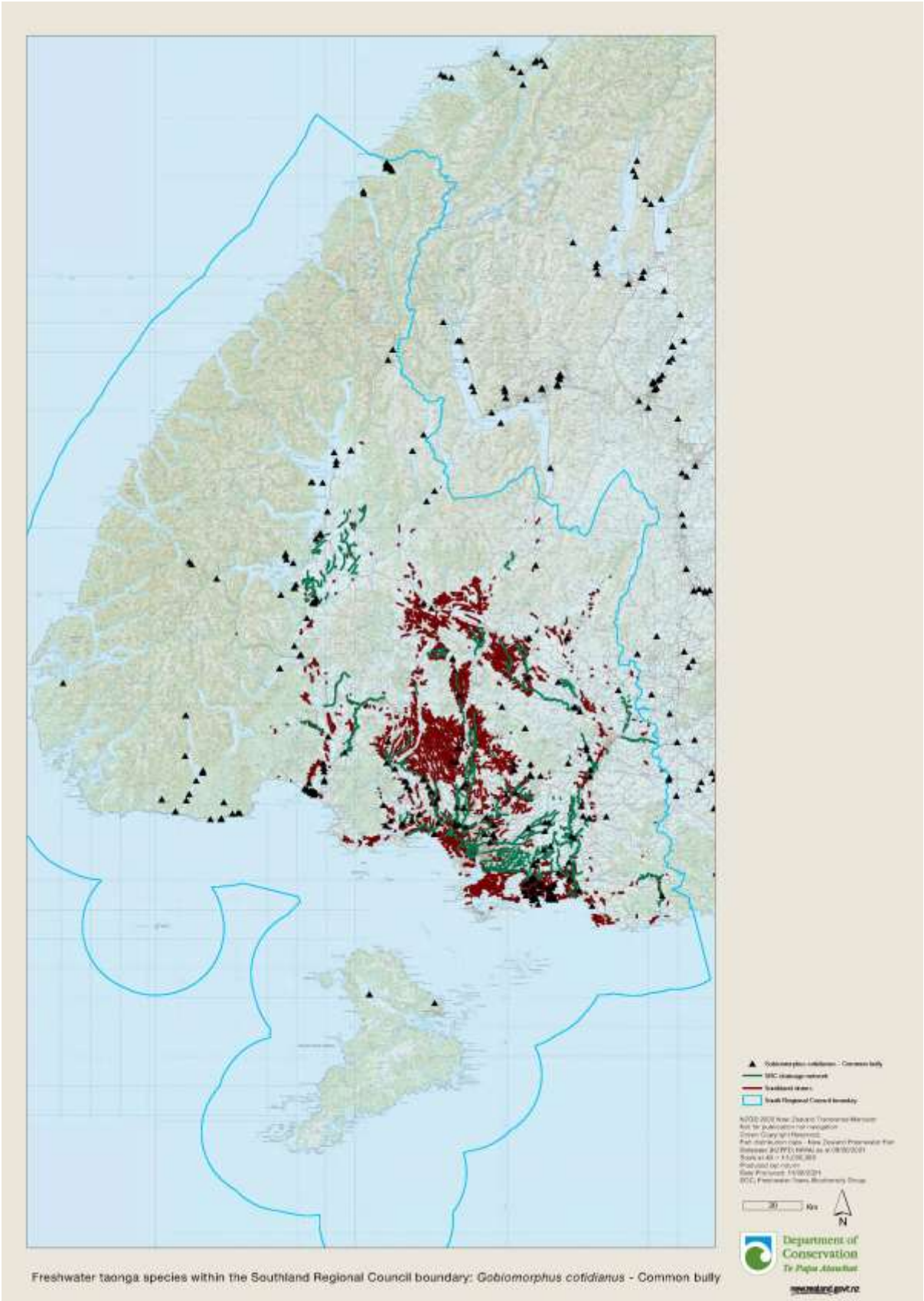
Freshwater taonga species within the Southland Regional Council boundary: *Galaxias* "species D" - Clutha flathead galaxias (Clutha River)



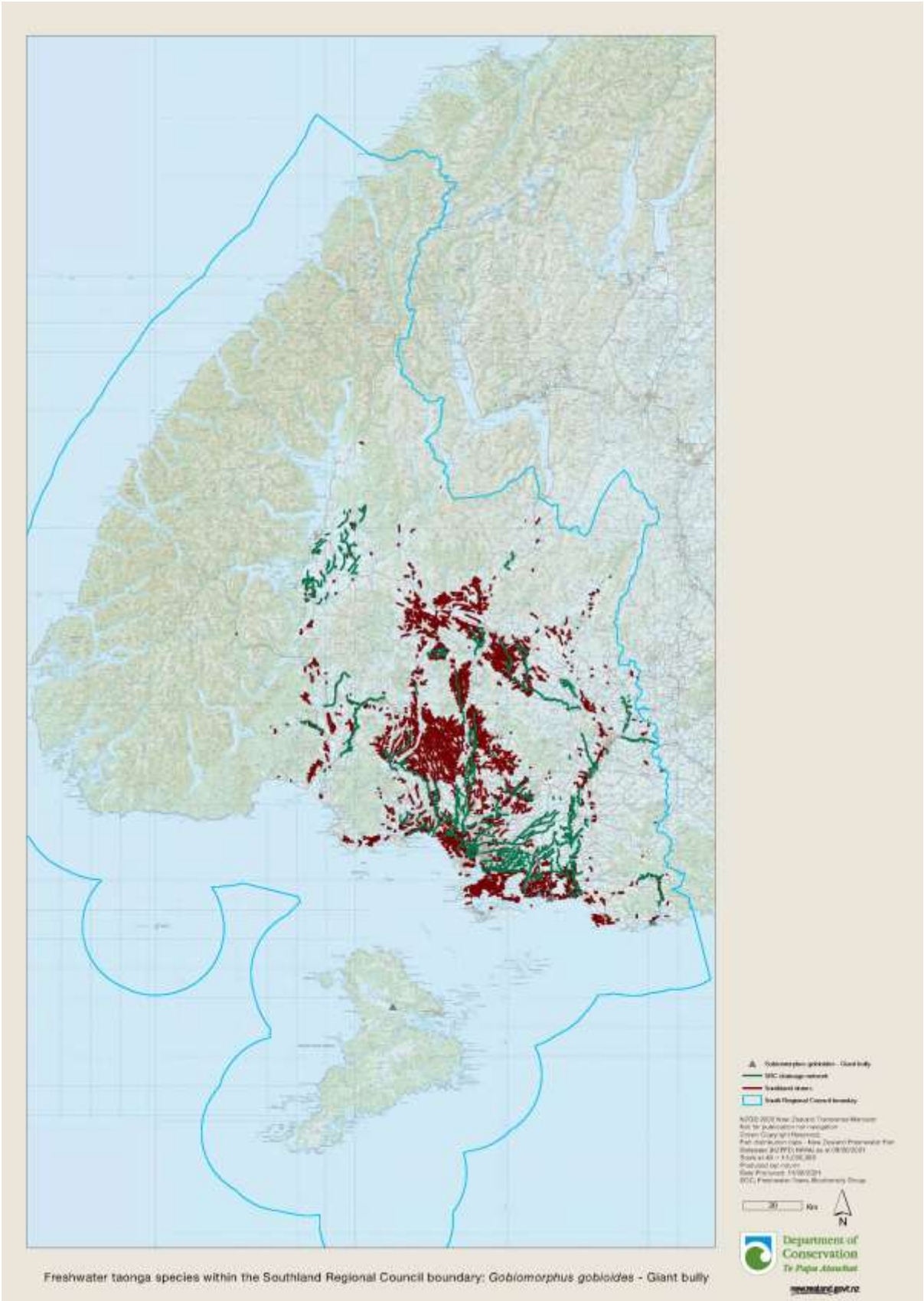
Freshwater taonga species within the Southland Regional Council boundary: *Geotria australis* - Lamprey



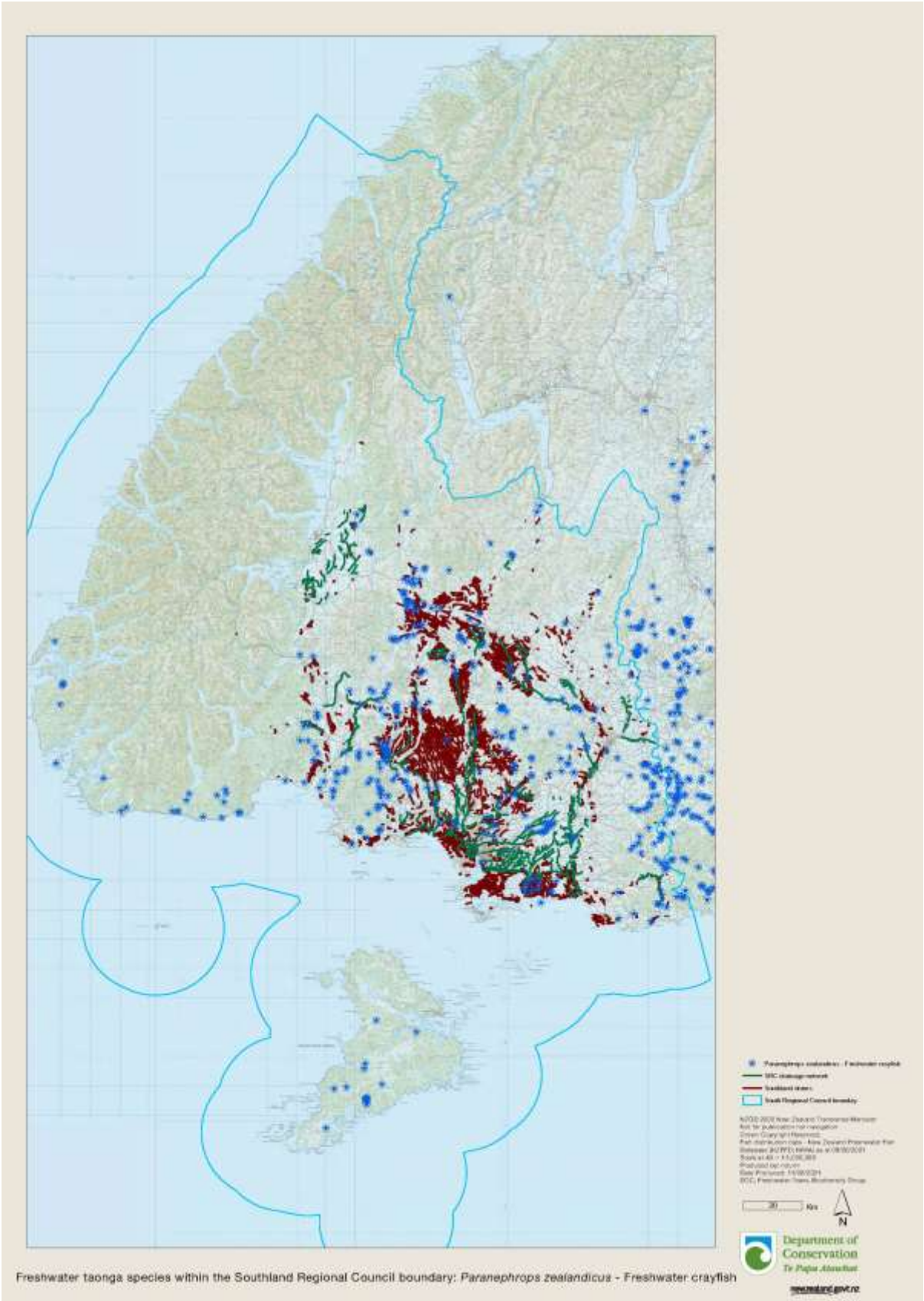
Freshwater taonga species within the Southland Regional Council boundary: *Gobiomorphus breviceps* - Upland bully



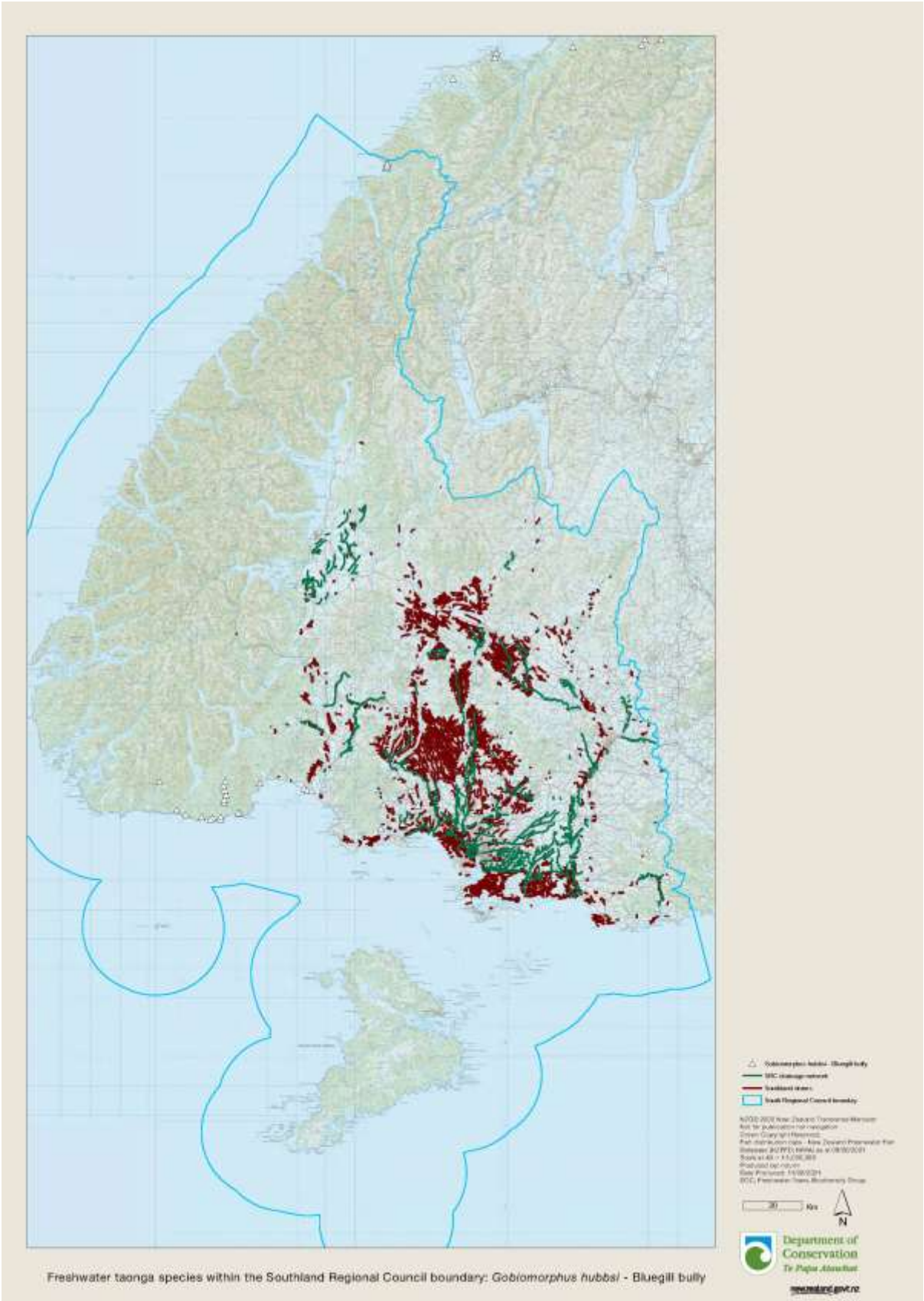
Freshwater taonga species within the Southland Regional Council boundary: *Gobiomorphus cotidianus* - Common bully



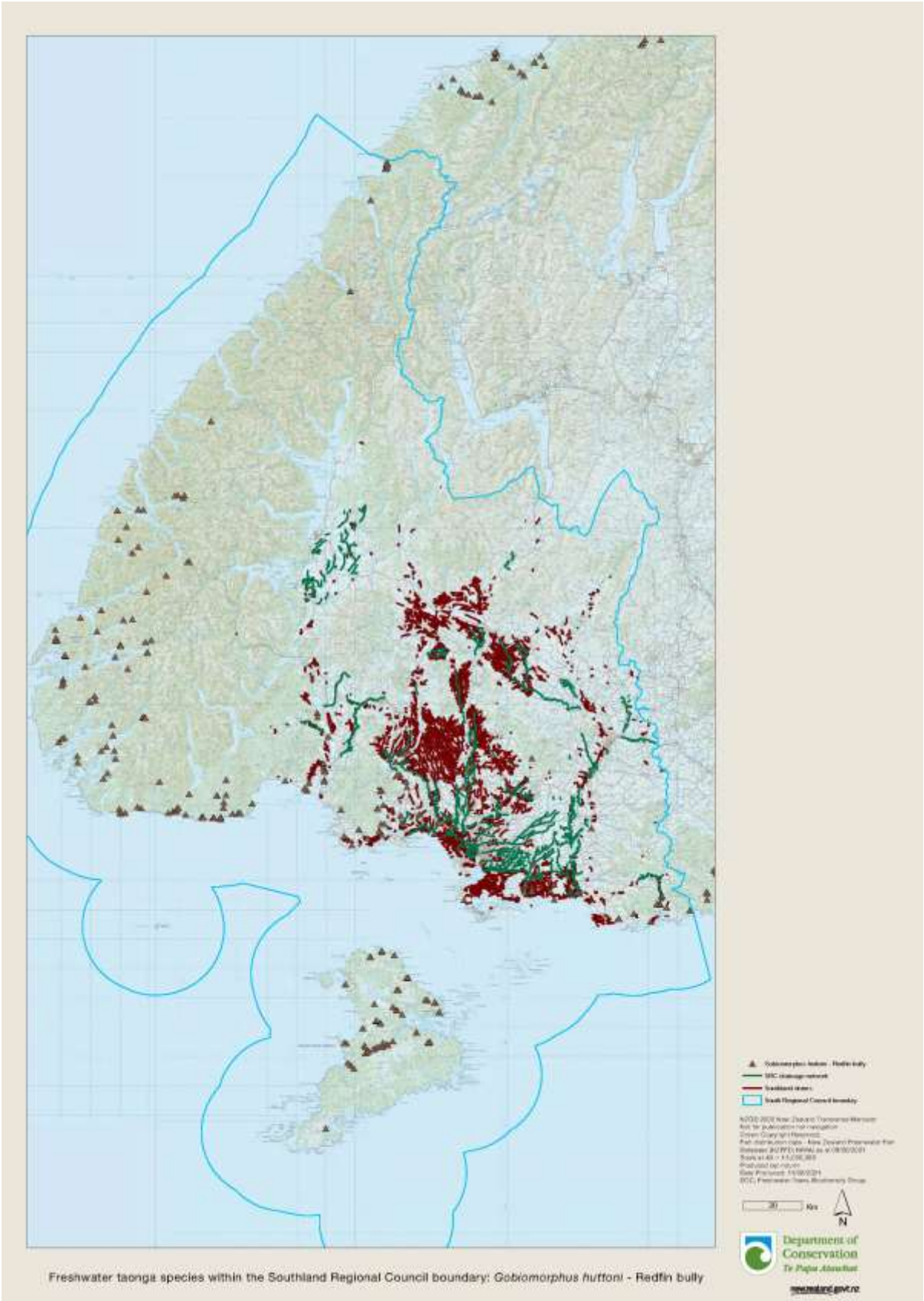
Freshwater taonga species within the Southland Regional Council boundary: *Gobiomorphus gobioides* - Giant bully



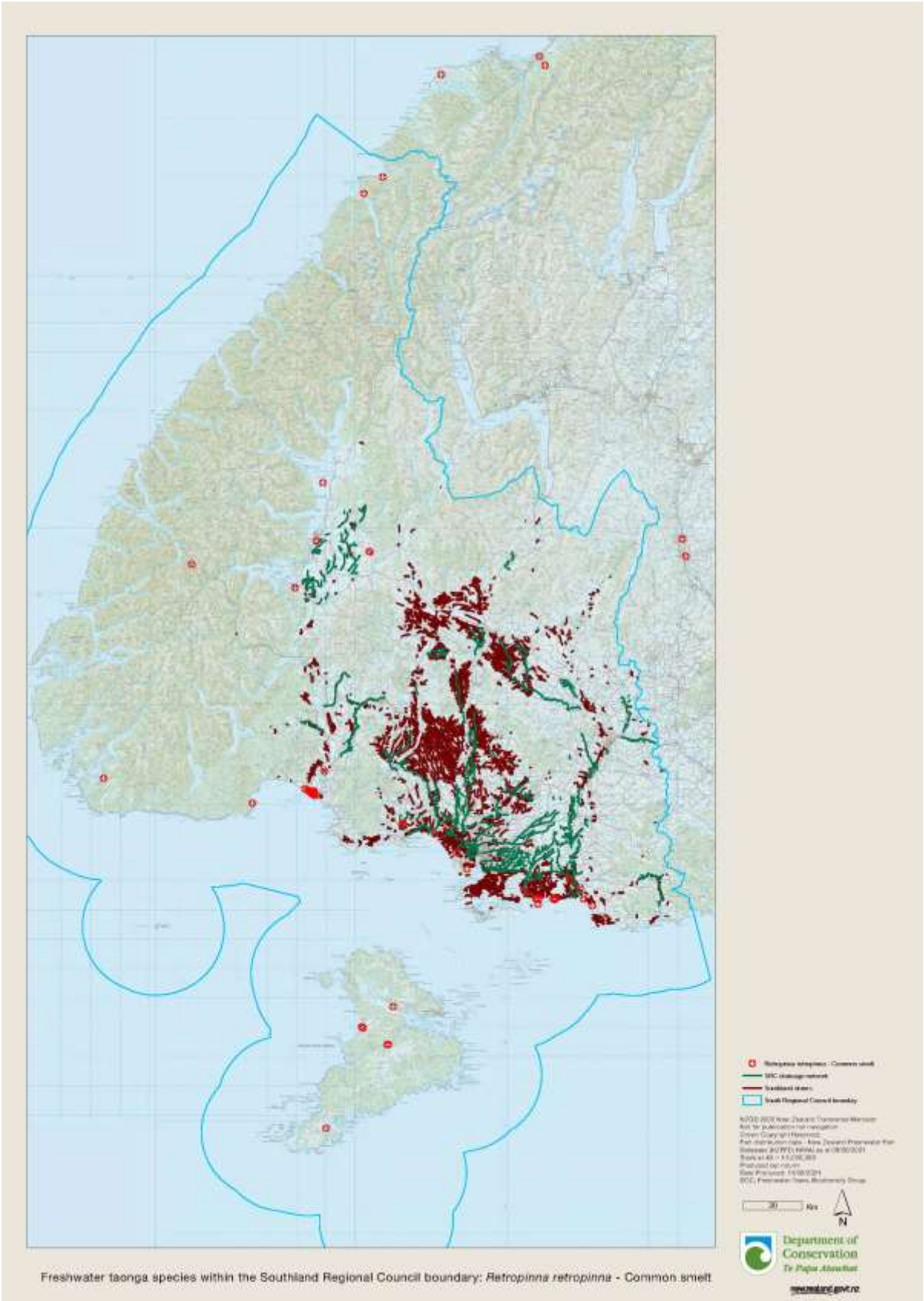
Freshwater taonga species within the Southland Regional Council boundary: *Paranephrops zealandicus* - Freshwater crayfish



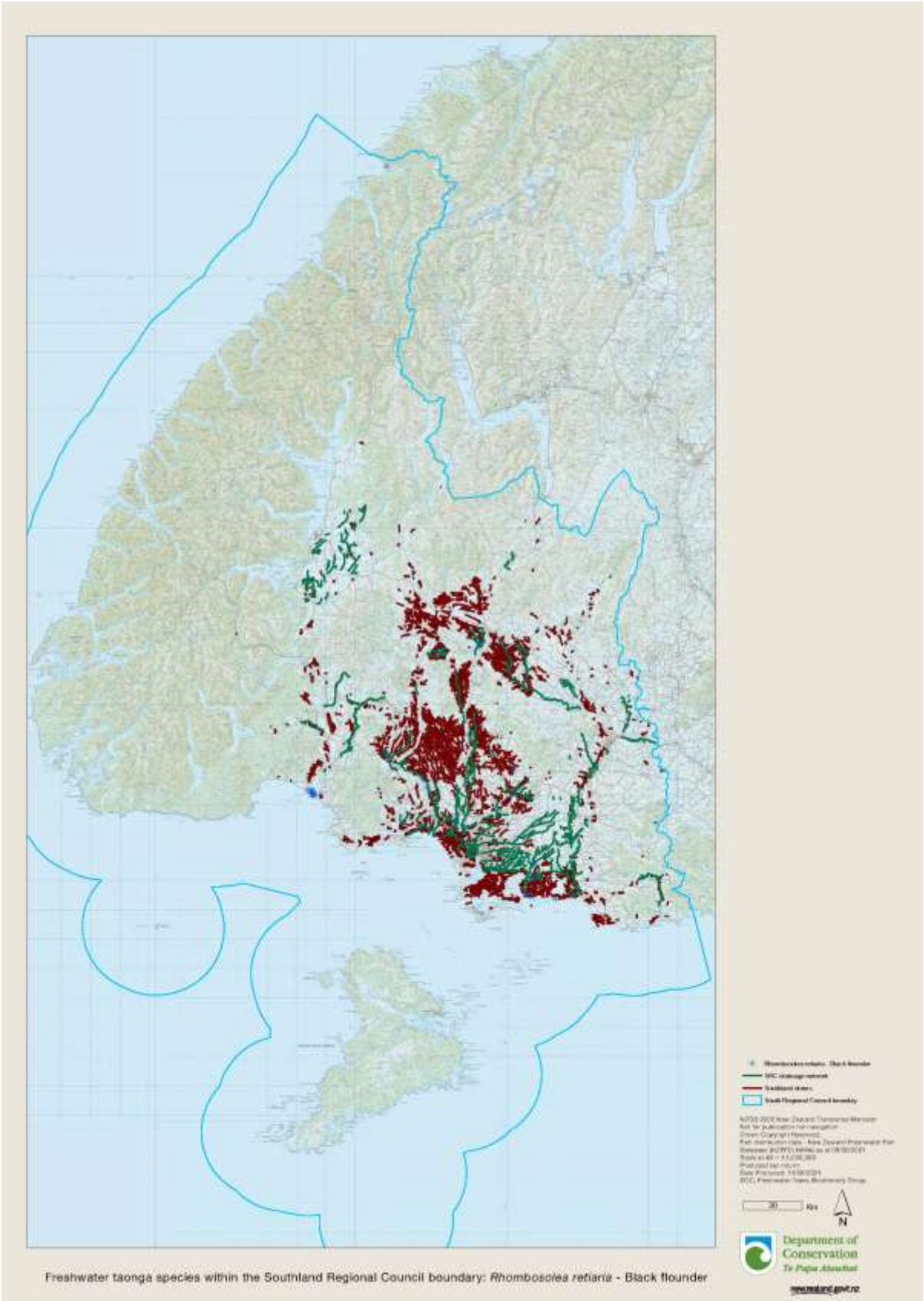
Freshwater taonga species within the Southland Regional Council boundary: *Gobiomorphus hubbsi* - Bluegill bully



Freshwater taonga species within the Southland Regional Council boundary: *Gobiomorphus huttoni* - Redfin bully

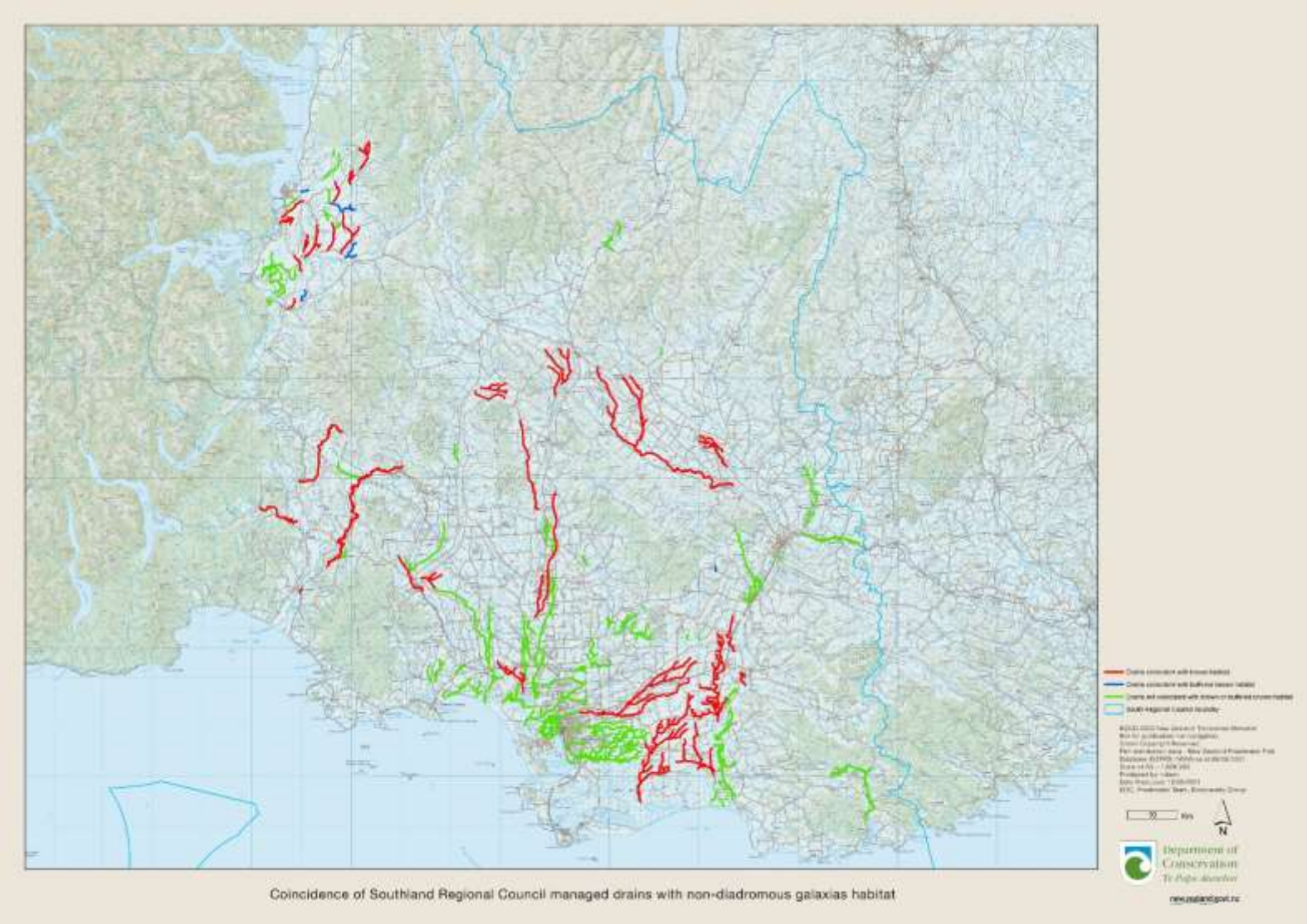


Freshwater taonga species within the Southland Regional Council boundary: *Retropinna retropinna* - Common smelt



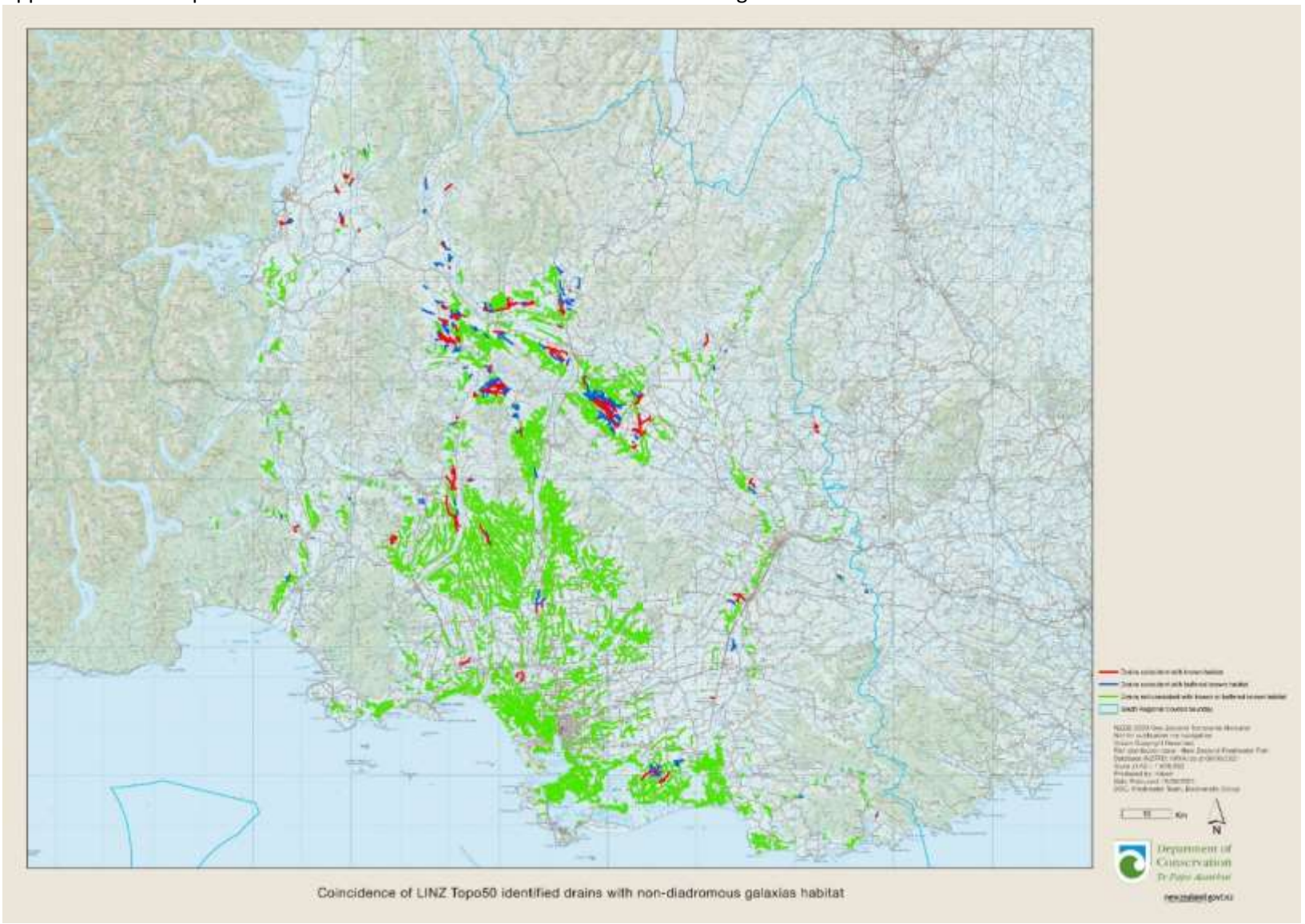
Freshwater taonga species within the Southland Regional Council boundary: *Rhombosolea retiaria* - Black flounder

Appendix 2. Southland Regional Council managed drains coincidence with non-diadromous galaxias habitat



Coincidence of Southland Regional Council managed drains with non-diadromous galaxias habitat

Appendix 3. LINZ Topo50 identified drains coincidence with non-diadromous galaxias habitat



Coincidence of LINZ Topo50 identified drains with non-diadromous galaxias habitat