

Conceding the Ocean

James Bennett¹

Introduction

Salmon farming in southern Chile grew from a roughly \$160 million industry in 1991 to over \$2.2 billion in 2006.¹ After the outbreak of Infectious Salmon Anemia (ISA) in 2007 and 2008, the industry lost thousands of jobs and millions of dollars. This catastrophe prompted greater involvement from governmental agencies through increased transparency and regulation of the industry. The aquaculture policy-making body, the Undersecretariat of Fisheries (*Subpesca*), publicly released the geographical coordinates for all currently operating concessions. An aquaculture concession is the institutional mechanism that permits private production within state-controlled waters. To combat the devastating disease, the National Fisheries Service (*Sernapesca*), which is the control and enforcement branch of *Subpesca*, enacted the “Program for ISA Surveillance and Control” in October of 2008. Part of this program demarcates zones of surveillance and infection. The final agency of the concession-granting process, the Undersecretariat of Marine Affairs (*SubsecMar*, responsible for coastline management), approved numerous concessions within the cautionary zones after the ratification of the ISA Surveillance and Control Program. Is there a particular spatial pattern to these newly granted concessions that justifies their authorization within existing zones of surveillance and infection? Spatial statistical analyses support the hypothesis that the placement of these particular concessions is indeed more responsible than that of past authorizations. Nevertheless, lessons learned from the Norwegian salmon farming industry’s experience with ISA in the 1980s and 1990s should raise questions as to the advisability of additional authorizations in Chile during *Sernapesca*’s ISA Program.



Pinochet. Hated, loved and feared: Pinochet’s (seated) repressive regime subscribed the Chilean economy to neoliberal macroeconomic policies, the effects of which are hotly debated. Credit: <http://www.indymedia.ie/article/77927>.

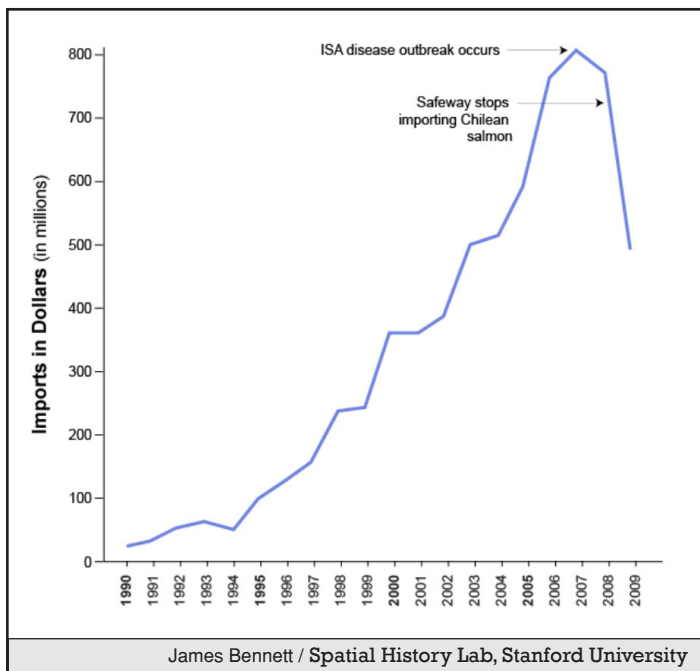
Background

Export-led wealth increased greatly during Chilean General Augusto Pinochet’s dictatorship from 1973-1990. Influenced by graduates of the Chicago School of Economics, Pinochet transformed the economy of his Socialist predecessor, Dr. Salvador Allende, into a paradigm of neoliberalism, with a strong emphasis on privatization, free trade, foreign direct investment and fiscal frugality. While the social costs of the abrupt policy transformation were high, such as a 20% decrease in real wages, an overall increase of 8% unemployment (to 14%), and significant increase in extreme poverty, the experience did earn Chile the title of an “economic miracle.”² Even after the peaceful transition to democracy in 1990, the subsequent center-left coalitions that held power for the next twenty years maintained the economic pillars of Pinochet’s governance.

Tremendous GDP growth in the ten years after the transition (about 7% per year) coincided with the rapid expansion of a particular export-led industry, industrial salmon aquaculture. Not endemic to the southern hemisphere, salmon were first introduced to Chile in the nineteenth century.³ After decades of failed attempts to acclimate salmon, profitable farms began floating during the Pinochet dictatorship. In 1987, Chile’s first salmon exports shipped off to the United States; in 2005, Americans consumed 30% of the 384,000 tons exported from Chile (Japan was higher with 39%).⁴

The rapid pace of growth fell off in July of 2007, when the viral Infectious Salmon Anemia (ISA) began to spread through southern Chile.⁵ The symptoms of the contagion include lethargy, swelling

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United States Imports of Chilean Atlantic Salmon. Though American demand helped to propel Chilean salmonid aquaculture, consumers reacted sharply to disease breakout. The giant-retailer Safeway, for example, stopped buying Chilean salmon in 2008. *Source:* USDA Economic Research Service 2010, <http://www.ers.usda.gov/Data/Aquaculture/SalmonImportsValue.htm>.

of the spleen and severe anemia, often resulting in high rates of mortality.⁶ ISA transmits through Atlantic salmon populations and geographic areas by direct contact with contaminated salmon, fish handlers, and equipment.⁷ While the disease does not transmit to humans, it can wipe out farmed salmon populations and force early harvests of farmed fish that make them less marketable. Thus, 2008 and 2009 witnessed the loss of an estimated 30,000 jobs in southern Chile and economic costs on the order of hundreds of millions of dollars of foreign exports.⁸

The losses incurred by both laborers and capitalists prompted the central government to enact greater industry transparency.



The various state-run organs that oversee industrial aquaculture have published thousands of industry-related records. One such record, “Complete Information of Aquaculture Concessions,” on *Subpesca*’s website supposedly lists all current maritime territories that the central government has granted to producers.⁹ It provides the title of the concession holder, date granted, area, species farmed, and the geographical coordinates.

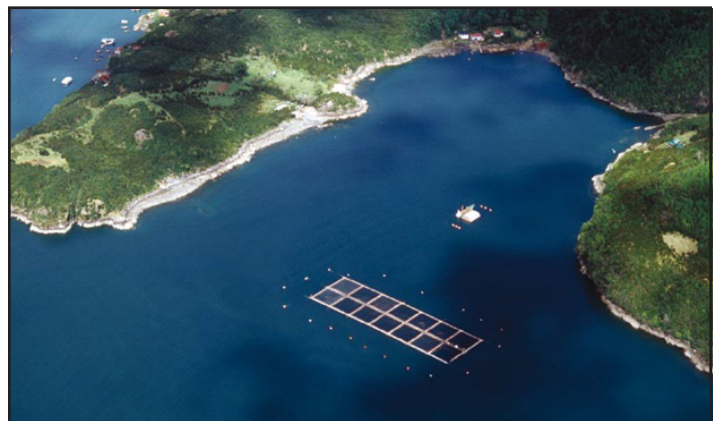
To practice aquaculture, one must obtain permission from the central government in the form of a ‘concession.’ The concession applicant (who must be a Chilean national, foreigner with permanent residence, or Chilean legal entity) must push through several levels of bureaucracy to gain one. In accordance with the 1989 General Law of Fisheries and Aquaculture (*Ley General de Pesca y Acuicultura*) and its subsequent amendments, concession-seekers must first acquire the permission of *Sernapesca*, next *Subpesca*, and then *SubsecMar*. Upon securing the necessary



Atlantic Salmon Victim to ISA. An unfortunate Atlantic salmon that fell victim to ISA; debate continues as to whether humans may too. *Credit:* <http://aqua.intervet.com/news/2007-11-22.aspx>.

authorizations, the individual or company pays the first annual fee and then officially holds the concession. The amount of the fee depends only on the area of an individual concession (not the farmed species); those under 50 hectares cost about 75 dollars per hectare (this price doubles for each hectare exceeding 50). Some critics of the process rue the four to seven years it takes to weave through the bureaucratic procedures; others contend the pricing is eschewed, as concessionaires pay only for the surface area, while they also utilize the volume of water under the surface to farm their product. Regardless, the annual concession fee has consistently amounted to less than 1% of the salmon industry’s total revenue.¹⁰

In addition to increased transparency, *Sernapesca* augmented its regulatory role of the industry in reaction to the ISA outbreak. In October of 2008, it released the Specific Health Program for the Surveillance and Control of ISA (*Programa Sanitario Especifico de Vigilancia y Control de ISA*). Monthly health inspections, the

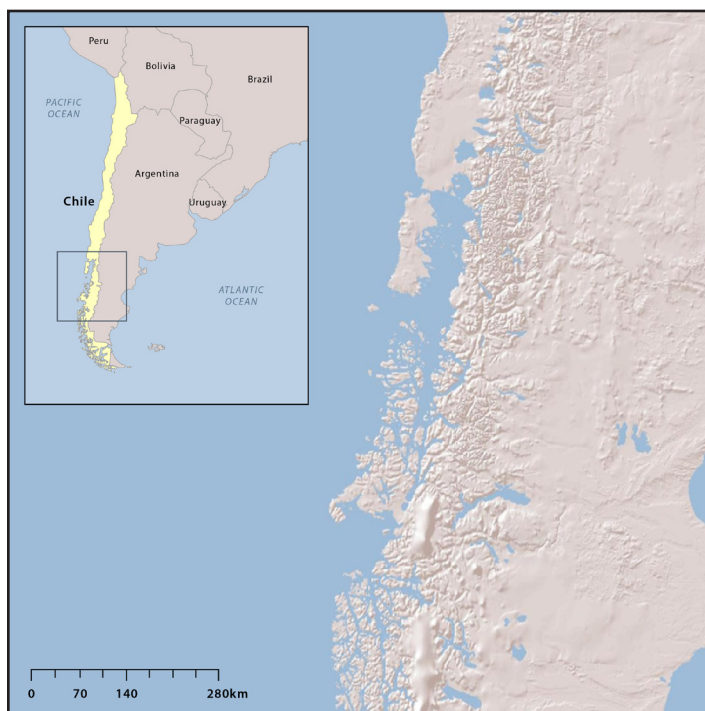


Salmon Farm. A salmon farm in operation. The authorized concession area is probably a bit larger than the visible pens, so as to leave sufficient space to circulate them. *Credit:* http://www.aqua-sur.cl/2010/pdf/Investment_Opportunit_Salmon_Industry.pdf.

forced ‘fallowing’ of infected farms, an embargo on imported salmon eggs, and the delineation of Surveillance and Infected Zones comprised the regulatory mechanisms of the program. According to the *Sernapesca* website, the geographical representation of the Surveillance Zones (*Zonas de Vigilancia*) and Infected Zones (*Zonas Infectadas*) were made publicly available on October 24th, 2008, and January 1st, 2009, respectively.^{11,12} An area is demarcated as ‘under surveillance’ if it is within 10 kilometers of a specific outbreak site, or deemed potentially dangerous for other reasons, such as water flow from infected areas. The Infected Zones consist of the area within a 5 kilometer radius of a known or suspected outbreak site, of which the document denotes 65 (28 known and 37 suspected). It is curious that *Sernapesca* released the Infected Zones two months after the Surveillance Zones, as the specific outbreak sites dictate the delineation of both areas (mostly). Thus, we assume the 24th of October, 2008 as the date of origin for both types of zone. Most all Surveillance and Infected Zones exist in Chile’s southern Regions X and XI, where the majority of salmon farming occurs.



Regions X Processors. Salmon fillets require a sharp knife and sharper concentration; the absence of either may result in injury. These processors in Region XI focus on achieving a safe, yet productive pace. Credit: Reuters/Ivan Alvarado/Files; Photo by Simon Gardner



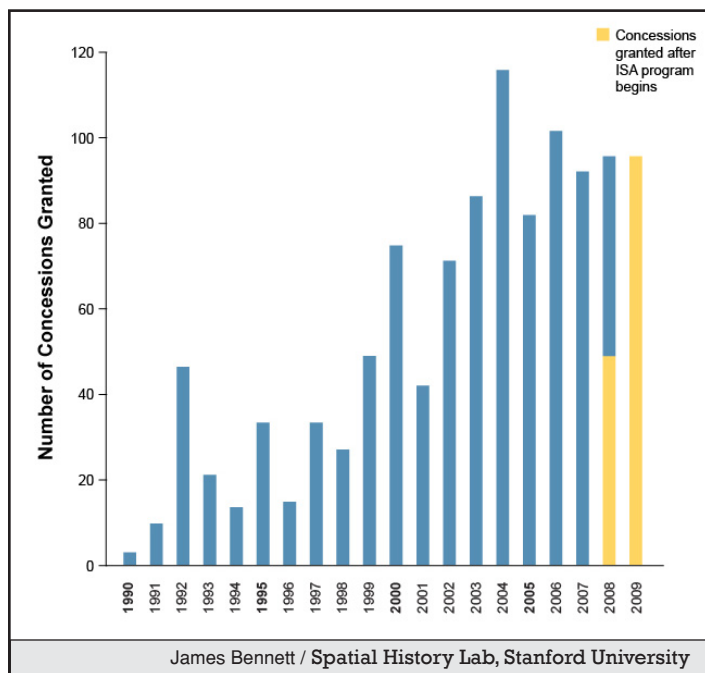
Regions X and XI. The Southern Cone of South America, with Regions X and XI close-up. The unique physical geography makes the area well-suited to aquaculture.

The two regions’ rare perfect oceanic temperature, physical geography and abundant local labor enable the competitiveness of large-scale salmon farming. In Region X, the large island of Chiloé provides a shield from oceanic turbulence and currents, as do the multiple smaller islands of Region XI. Both regions are fjordic, resulting in long and densely packed stretches of protected coastline. The inexpensive labor force consists mainly of Chilotes (residents of Chiloé Island) and other locals, many of whom were formerly artisanal fisherman and farmers before the ‘salmon boom.’ While the industry has provided over 45,000 jobs

to this population, it has also impeded traditional artisanal fishing practices, as workers not only spend more time in the processing plants, but also are excluded from fishing in the 25,500 hectares of previously accessible oceanic surface area that now belong to the holders of the 2,965 total granted concessions.

Mapping the Data

Contrary to its title, *Subpesca*’s concession data does not tell the whole story. It excludes concessions that ‘expired.’ Expiration



Authorized Concessions to Farm Salmon. Salmonid aquaculture concessions granted by *SubsecMar*. The orange represents those granted after the promulgation of the Program for ISA Surveillance and Control in October of 2008.

occurs for a variety of reasons, like a bankrupt owner or a string of negative Environmental Impact Reports. Thus, one can only get a sense of the salmon boom years, not the bust, from the data. Graph 2 demonstrates this one-sided story. Notice the steady rate of increase of granted concessions over the years. However, this is misleading, as the data does not display concessions granted in past years that have fallen victim to ISA. Despite the lack of this information, the number of concessions granted *after* the establishment of the ISA Surveillance and Control Program (depicted in orange), beg the question: Where, specifically, were these concessions granted?

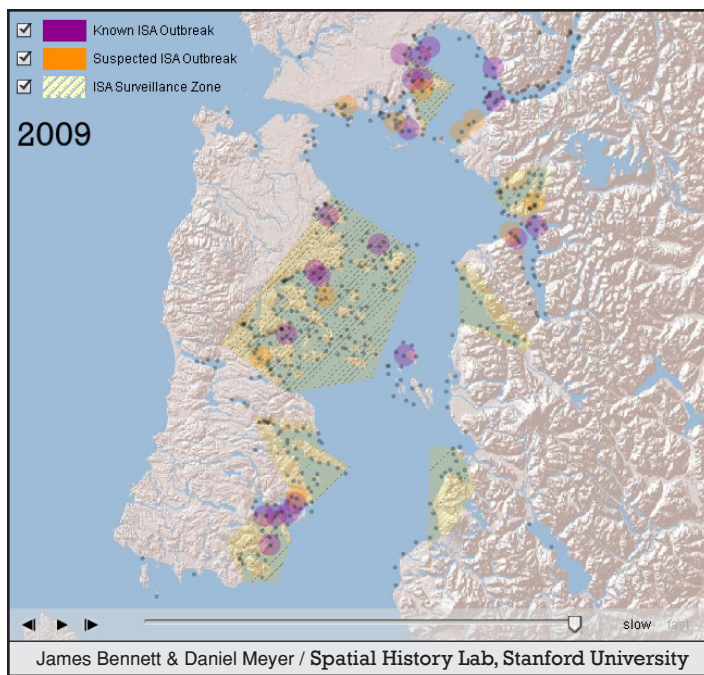
To find out, we input the *Subpesca* concession data (including ‘non-salmon’ concessions) into ArcGIS and symbolized each with a point. Immediately, one notices the overwhelming number of currently operating concessions, especially around central Chiloé, where they appear to saturate the ocean surface. Next, we incorporated *Sernapesca*’s Zones of Surveillance and Infection, layering these features over the granted concessions. Finally, using *SubsecMar*’s granting date, we animated the historical growth of the salmon industry concessions.

Visualizing the layered data with GIS, one sees that in addition to granting a similar number of concessions both before and during *Sernapesca*’s ISA Program, *SubsecMar* granted some of these *within* zones of Surveillance and Infection during the Program. The ISA Surveillance and Control Program does not mention the granting of new concessions; yet, accepting that overly-dense placement of salmon farms enables the rapid spread

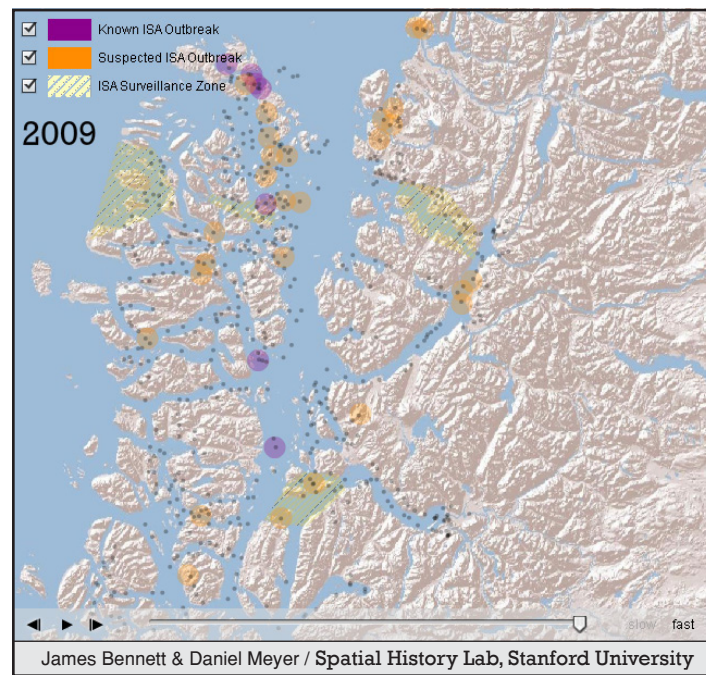
of ISA, it is reasonable to think authorizations might decrease or cease during the period of the program. While the ISA “spread-by-proximity” theory is contended, ample evidence supports it.¹³ Thus, on the surface, it looks as if the granting agency is wrought with corruption, incompetence, or both. Is this the case, or was *SubsecMar* more concerned with the region’s high unemployment rate and thus attempted to ameliorate the problem by increasing productive areas?

To answer part of this complex question, we filtered out ‘non-salmon’ concessions, divided the remaining data into four temporal layers, and ran ten statistical analyses of distance. The four temporal layers are: concessions granted before 2007, granted in 2007, granted before Oct. 24th, 2008, and granted from Oct. 25th, 2008 (date of zoning coordinate release on internet) until Dec. 31st, 2009 (for our purposes we refer to this final layer simply as 2009). This classification provides two snapshot years of concession-granting (2007 and 2009) within the context of already-existing concessions for those respective years.

We measured the average distance of concessions granted both in 2007 and in 2009 to the particular Outbreak Sites and to the coastline.¹⁴ We also calculated the average distance of 2007 and 2009 concessions to the already-existing concessions of those particular years for three layers: within the whole region, the Surveillance Zones, and the Infected Zones. These specific spatial analyses of the government’s concession-authorizing behavior, based on the location of individual concessions themselves, provide a new, albeit incomplete, perspective with which to speculate on



Region X. This visualization shows the accumulation of salmon farming concessions (that were granted in the area of study) from 1982 through 2009.



Region XI. This visualization shows the accumulation of salmon farming concessions (that were granted in the area of study) from 1982 through 2009.

governmental actions.

Results and Discussion

The results of the analyses are summarized in Table 1:

Average Distance of Concessions to...	For concessions granted in...	
	2007	2009
ISA outbreak locations of 2008	4.0 km	12.1 km
Coastline (in Region X only)	0.7 km	1.5 km
All other existing concessions	5.7 km	3.5 km
Other concessions within Surveillance Zones	3.1 km	3.2 km
Other concessions within Infected Zones	5.4 km	2.6 km
James Bennett / Spatial History Lab, Stanford University		

Table 1.

Based on the statistical analyses, *SubsecMar* was cautious in authorizing concessions relatively close to actual outbreaks, evident in the average 12.1 km distance from these locations in the 2009 data, compared to the average 4.9 km before the acknowledgment of these specific outbreak points. The concessions granted in 2009 are closer to pre-2009 existing concessions throughout the study region (an average distance of 3.5 km) than 2007 concessions are to pre-2007 existing concessions (a mean distance of 5.7 km). This is natural, because there are simply more concessions within the same area.

However, the Surveillance Zones are also confined areas. But the average distance from new to existing concessions does not differ greatly for 2007 and 2009 (3.1 km and 3.2 km, respectively), despite the addition of 40 concessions in 2009. The nearly equal average distance between concessions for the two years within the Surveillance Zones supports the notion that the government is attempting to spread out the new concessions. If one accepts that the Surveillance Zones are probably the best place to engage in salmon-culture (as the industry has centered there), then it appears that *SubsecMar* is trying to maximize industry profitability, as it more carefully disperses concessions within this still desirable region.

The distance-to-coast measure further reflects the apparent general spreading-out of concessions, as the 2009 concessions are on average twice as far away from the coast as 2007 concessions. This is significant considering salmon producers most likely want to operate closer to shore to facilitate business.

The Infected Zone analysis is the only one that suggests authorization irresponsibility. Those concessions granted in 2009 are on average twice as close to existing concessions than those granted in 2007. Perhaps the acquiring party agreed to postpone productive activities? Perhaps the areas had been cleared of fish by the time these concessions came to fruition? In any case, the most current data demonstrates a rather concerning proximity between newly-authorized concessions and existing concessions within Infected sites.

Conclusion

Despite *SubsecMar*'s seeming sensibility in authorizing geographically well-placed concessions after the enactment of the ISA Program, when one expands his or her view to an international perspective, the actions of *SubsecMar* are still questionable. During the early 90's, Norway had a similar experience with Infectious Salmon Anemia. After similar losses in profits and jobs, the government increased its regulatory role. One mechanism laid the basis for such an approach: strict limitations of farm proximity. Scientific research suggested a distance of no less than 5 kilometers between production operations.¹⁵

End Notes

1. SalmonChile; taken from Pablo Camus and Fabian Jaksic.
2. Petras and Vieux (1990). The Chilean "Economic Miracle": An Empirical Critique. pp. 57-72. Critical Sociology.
3. Pablo Camus and Fabian Jaksic. Piscicultura en Chile: Entre la Productividad y el Deterioro Ambiental 1856-2008. Pontifica Universidad Catolica de Chile 2009.
4. Ibid.
5. USDA Foreign Agricultural Service 2009, found at http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Fisheries%20Products%20Voluntary%20Report%202009_Santiago_Chile_11-06-2009.pdf.
6. USDA 2002, found at <http://www.aphis.usda.gov/lpa/pubs/tnisa.html>.
7. Ibid.
8. Chilean National Customs Service, taken from Inter Press Services, <http://ipsnews.net/news.asp?idnews=52493> August 15, 2010.
9. Found at: http://www.subpesca.cl/template/0foto/..%5C..%5Cdocs%5CInformaci%C3%B3n_concesiones_solicitudes_hasta_el_14-04-2010.xls.
10. SalmonChile.
11. http://www.sernapesca.cl/index.php?option=com_content&task=view&id=559&Itemid=654 (download pdf at bottom of images)
12. http://www.sernapesca.cl/index.php?option=com_remository&Itemid=246&func=select&id=352 (download both map pdfs)
13. See Vågsholm et al., 1994; Jarp and Karlsen, 1997; Thorud and Håstein, 2002; Løvdal and Enger, 2002; McClure et al., 2005; Gustafson et al., 2005; Scheel et al., 2007; and Lyngstad et al., 2007, among others.

14. Due to insufficient data, we measured the distance to coast for Region X only.
15. *Experiences With Regulatory Responses to Infectious Salmon Anemia in Norway* Kristin E. Thorud and Tore Håstein

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Supplementary Information is linked to the online version of the paper at <http://spatialhistory.stanford.edu/publications>.

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