Marine Policy xxx (xxxx) xxx

Contents lists available at ScienceDirect

Marine Policy

journal homepage: http://www.elsevier.com/locate/marpol

Full length article

Change as a permanent condition: A history of transition processes in Dutch North Sea fisheries

L. van Hoof *, N.A. Steins, S. Smith, M. Kraan

Wageningen Marine Research, part of Wageningen University and Research, the Netherlands

ARTICLE INFO

Keywords:
Transition
Governance
Fisheries
Collective sensemaking
Multi-level governance
Sustainable
Circularity

ABSTRACT

Centre of debate on food production in the Netherlands today focusses on the issue of realising a cyclical mode of production and operating in a climate neutral way. This transition is envisaged not only for agriculture, but also for fisheries. Dutch fisheries face a multitude of challenges in addition to, as well as related to this circularity transition. These include loss of operating space for fishing activities in the North Sea (windfarms, nature conservation areas, Brexit) and the need for further development of sustainable fishing methods and vessels (innovations to reduce ecological and environmental impacts). Whilst the Dutch fisheries face these challenges now and in the future, it has already gone through significant changes over the past 70 years. Since the dawn of fisheries policy in Europe in the 1970s, change and development have been part of the fishing industry, indicating that transitions and change are a permanent aspect of fisheries. From past transitions lessons can be learnt to take on current and future challenges. Past transitions in Dutch fisheries were analysed from the perspective of transition and governance. Based on literature and reports produced in recent decades and pooled knowledge gained from the fishing industry, government and environmental organisations, this paper shows that the roles of the different actors involved changed during past transitions, with a shift in playing field occurring from a regional to a European scale and that joint problem definition, collective sensemaking and a long term vision are essential in navigating transition waters.

1. Introduction

Transitions can be defined as gradual, continuous processes of change where the structural character of a society transforms [1]. Transitions in fishing are of all times (see for example [2–5]) in which structure, practice and culture of the fishery are changing, as a result of e.g. technological, social, environmental, economic and policy developments. In an attempt to obtain more sustainable ways of fishing, governments increasingly take an initiating role in these kinds of transition processes [6–9]. In recent years, insights in how fisheries and the ecosystem interact were included in the European objectives of fisheries management [10–12].

In 2018, the Minister of Agriculture, Nature and Food Quality of the Netherlands embarked on a process towards more sustainable production in agriculture and fisheries, with circularity and resource use efficiency as the guiding principles [13,14]. For the fisheries sector, the main challenges have been identified as improved selectivity of fishing gears (to reduce unwanted bycatch), reduced fishing impact on the seabed, and reduction of emissions [13 p27].

The Dutch current call for a transition towards a more nature inclusive circular fisheries system comes at a time when particularly North Sea fishers are facing many challenges [4]. With an increased allocation of space at sea for nature conservation and for renewable energy production (offshore wind farms), the area for fishing will be reduced considerably. In addition, the sector may lose important fishing grounds as a result of the expected Brexit. The European ban on pulse trawl fisheries and the implementation of the landing obligation put additional pressure on this transition process. Yet, transitions are not a new phenomenon in Dutch fisheries (see for example [2,4,15]). From the inception of (international) fisheries management in the North East Atlantic in the 1970s until today several periods of fundamental change have taken place.

Using the case of the Dutch North Sea fisheries this paper applies governance theory [16–20] and socio-technical transition theories [1, 21–24] to analyse how transitions come about in practice, with special attention to the interactions between institutions and social initiatives, to determine the roles of the different actors involved. It shows that the roles of the different actors modified, with a shift in arena occurring

* Corresponding author.
E-mail address: Luc.vanhoof@wur.nl (L. van Hoof).

https://doi.org/10.1016/j.marpol.2020.104245
Received 7 May 2020; Received in revised form 28 August 2020; Accepted 30 September 2020

from a regional to a European scale and that joint problem definition, collaborative sensemaking and a long term vision are essential in navigating transition waters. The analysis contributes to an action perspective for the transition to a circular and climate-neutral society.

This paper is based on an analysis of existing literature and reports on developments and challenges of the Dutch North Sea fleet published over the past decades. The findings from the document review were evaluated against transition and governance theory. In this analysis, the paper also builds on work the authors have been involved in over the decades, and is based on discussions, interviews and workshops with actors from the fishing industry, government and environmental organisations. While many changes apply to all Dutch fisheries, the analysis focuses on the flatfish fleet. This fleet has gone through more significant changes than any other fleet segment [4] and is currently also the focal point of significant policy changes regarding the North Sea [25].

The next section presents a short reflection on the theoretical concepts of transitions and governance. This is followed by a description of the case of the Dutch North Sea flatfish fleet and the transitions it has gone through since the first international fisheries management measures came into play. By using a governance perspective to transitions, focussing on the question 'who does what', we analyse the different periods of transition in section four. The paper concludes with a discussion of lessons learnt for transitions to come.

2. Defining transitions

A transition is understood to be a fundamental reconfiguration of activities [26 p17]. This implies a fundamental change in structure (e.g. organisations, institutions), culture (e.g. norms, behaviour) and practices (e.g. routines, skills) [27,28]. Rotmans et al. (2001) define transitions as 'transformation processes in which society changes in a fundamental way over a generation or more, or more specifically as gradual, continuous processes of change where the structural character of a society (or a complex sub-system of society) transforms' [1 p15]. These authors argue that transitions are not uniform, nor is the transition process deterministic: there are large differences in the scale of change and the period over which it occurs [1]. Hence transitions require societal change at multiple levels ranging from individual behavioural change to community projects, businesses that offer alternative products as well as policy-makers that set suitable incentive structures [16].

This multi-level perspective on transitions [23,24,26] distinguishes three conceptual levels: (1) innovative practices (niche experiments), (2) structure (the regime), and (3) long-term, exogenous trends (the landscape) [21 p2]. Alternative practices (niches) operating outside established structures, cultures and practices are important sources of ideas and practices which can seed a transformation in the socio-technical regime, if processes at niche, regime and landscape levels of the system are supportive [29,30]. The regime-level consists of a network of actors and institutions that share a set of rules (laws, norms or shared categories) [31–34]]. Although institutions are apparently fixed they are not static as actors form institutions just as much as they are influenced by them [35]. Transition processes run across multiple dimensions (e.g. geographic, ecological, technological) [30]. The scale levels represent functional relationships between actors, structures and working practices that are closely interwoven. As economic, cultural, technological, ecological and institutional subsystems interact, they respond to changes in each other and adapt [26 p18].

To this multi-level perspective of transition, the notion of a multi-level governance perspective can be added [36]. This is particularly relevant in the case of EU fisheries management policies, which are prepared in a way that resembles neither traditional international politics nor policy-making by nation-states [10,11,37], and takes place in a complex nested setting where Member States, the European Council of Ministers, the European Commission and the European Parliament each play a distinct role. Transitions in Dutch North Sea fisheries have to be understood within the European (EU) context of the Common Fisheries Policy (CFP) [10,11,37]. With the concept of multi-level governance, it is possible to capture the shifting locus of governance from the state level to subnational and supranational levels. More specifically, multi-level governance points to sharing policy-making competencies in a complex system of negotiation [38].

There are various theoretical approaches towards understanding transitions with a focus on the role of the government (and governance) in change processes, the tools it has available and is willing to use in order to facilitate change, as well as the room for experimentation that is available for/given to industry-pioneers. Tukker and Butter (2005) distinguish four ways in which actors approach transition management: (1) the fatalist approach refrains from transition management (motto: 'First, disaster must happen'); (2) the hierarchic approach relies on a dominant actor coalition to steer change (motto: 'Let's put a man on the moon!'); (3) the individualist approach relies mainly on changing the financial ground rules (motto: 'Sustainability through the market'); (4) the egalitarian approach relies on process management, e.g. doing experiments (motto: 'A good transition arena will solve it all') [39 p94].

Transitions involve a range of possible development paths, of which government policy can influence direction, scale and speed, but never entirely control [1]. In this respect, it is important to point out that transition processes operate on a time scale of decades, whereas the policy time horizon is of a much shorter nature. In addition, steering towards a transition in a participatory way requires the government to be open, self-critical and creative, which can be at odds with the demands of the existing political world (with closed preferences, agenda driven, control) [20]. Grin (2011) furthermore argues that transitions are unlikely to result from traditional governmental action. Fora specifically created to legitimise transitions, such as transition arenas or experiments, are composed in a way which cannot produce *ex ante* legitimacy: they tend to primarily involve actors who are a priori sympathetic to the idea of the transition [21].

An important role in transitions is played by the structure of institutions and social practices, hence the regime. Institutions are seen as intermediary variables that act, as it were, as a filter between the interests and values of various actors and the decisions made in the political arena [40]. Social practices are routines used in daily life and are inherently shared, collective arrangements [41]. People are able to adjust part of a practice, which over time may add up, resulting in new or renewed practices. Thus both institutions and practices can change. Beunen et al. (2015b) accentuate a co-evolution perspective [42], whereby transitions are not the result of project- or social engineering but the result of a constant process of emergence and adaptation in a context of chaos, non-linearity, and path dependencies [43]. Weick perceives this process of change from one state to another as a process of order, interruption, and recovery [44,45]. Thus the agency of the government to steer transitions may be limited. Transitions often come about in an interplay between the different governance levels and in the interplay of actors resulting in structural change via change of institutions and practices.

To understand and give meaning to this transition process Weick [22, 44,46] introduces the concept of sensemaking. Sensemaking is the process by which people give meaning to their collective experiences [22,46,47]. The concept of sensemaking can be perceived from two angles. First, as a narrative giving meaning to a process of change; as such sensemaking is a retrospective process in which individuals first act and then reflect on their actions to interpret what they mean [48]. Secondly, as shown by Egan (2019), sensemaking can be a trigger for transitions by providing a narrative to induce change [49]; actors changing institutions by influencing colleagues to accept a novel view of a situation [50]. In addition, sensemaking can be a shared process, for example between policy makers, societal organisations and the fishing industry, in which a joint understanding of the change needed is arrived at [51,52].

Making sense of a process of transition towards sustainable societies

often proves to be rather difficult [53]. This is because it is difficult to define what sustainable development is [54–56] but also because the problems at hand are often wicked problems [54,57]. Problems are wicked when they are difficult to define and delineate from other and bigger problems and when they are not solved once and for all but tend to reappear [58]. Jentoft and Chuenpagdee [58] argue that fisheries management is confronted with problems that are inherently wicked. Wicked problems have no technical solution, it is not clear when they are solved, and they have no right or wrong solution that can be determined scientifically. One option to deal with wicked problems is engaging in collective and distributed sensemaking [59]. A complementary option is to simultaneously contribute to keeping wicked problems manageable through repeated small wins, based on careful observation and targeted actions [57,60]; recasting larger problems into smaller, less contentious problems, so people can identify a series of controllable opportunities of modest size that produce visible results that can be gathered into synoptic solutions [61].

In this paper, a multi-level conceptual perspective to transitions (niche, regime, landscape) as operationalised by Grin (2011) and to governance [38] will be used to analyse historic transitions in the Dutch North Sea flatfish fisheries and draw lessons for future transitions. These transitions are categorised by looking at the roles of government and other actors, assessing the development of institutions and practices and of the dominant narratives for individual, joint or shared sensemaking [22].

3. Case study: transitions in the Dutch North Sea flatfish fleet

3.1. The Dutch demersal fleet

The Dutch professional fishing sector comprises pelagic fishing, demersal fishing, shellfish fishing, (coastal) fishing with passive gear and inland fishing [4,37]. The demersal fleet is the largest segment in terms of number of vessels, capacity and turnover [62]. Its main component is the flatfish fishery in the North Sea, common sole (*Solea solea*) and plaice (*Pleuronectus platessa*) being the most important target species. Vessels with an engine capacity below 300 horsepower (HP) are also allowed to fish flatfish in the 12-mile zone of the North Sea. In addition to the flatfish fishery, a number of demersal vessels (most of them part of the year) fish for Norway lobster (*Nephrops norvegicus*) or non-quota species. Fishing for brown shrimp *(Crangon crangon)* either takes place by full-time dedicated vessels or on a seasonal basis (by <300 HP flatfish vessels). Today there are more than 300 demersal vessels, including 120 beam trawl vessels < 300 HP, 75 beam trawlers > 300 HP, 25 vessels using twinrig and/or flyshoot techniques and 90 dedicated vessels for brown shrimp [4].

The demersal catch is landed at one of the seven Dutch fish auctions. Processing takes place mainly within the Netherlands. About 80% of the most important target species of plaice and sole are exported. Italy, France and Spain are the most important destinations [63].

In the 2014–2016 period, the majority of the fishers targeting common sole (most of them in the >300 HP segment) switched to pulse fishing. The tickler chains of the beam trawl were replaced by electrodes producing pulses to chase the fish. As a result, seabed disturbance, undesired by-catches of undersized fish and benthic species, and CO_2-emissions have decreased significantly. At the end of 2016, 76 demersal fishers were fishing with the pulse gear [64].

The demersal fleet's gross revenue over the entire period 2016–2019 has been over 300 million euros [4]. It offers direct employment to 1162 FTEs (2016) [65], including people on board and shore-based personnel who carry out maintenance on nets and/or arrange technical operations ashore. Businesses are typically family-owned with a family possessing one or more vessels and fishing rights. The fishing trade is generally passed on from generation to generation, and fishers generally do not perceive their work only as a profession, but rather as part of their identity. Family members who are not fishing are usually actively involved in the management of the fishing company, processing or trading [4,15]. At local level the demersal fisheries contribute to social cohesion in fishing communities, provides employment in the ancillary or processing sector. Employment in the fisheries chain is hence more significant than the figures above suggest, as indirect employment also has to be taken into account [65].

3.2. Historic transitions in Dutch North Sea fisheries

In The Netherlands, fisheries and seafood trade are inextricably linked. Already in the 13th century King Edward I granted three Dutch provinces access rights to fish in the waters of Yarmouth [66]. Whilst throughout history there is documented evidence of fisheries management regulations at local or provincial level, it was not until 1857 that the basis for national management was laid. The 1857 Fisheries Act included regulations like vessel registration, closed seasons for certain fisheries, prohibition of certain gears and quality control (for herring), yet largely allowed for laissez faire management [66]. This approach also prevailed in the following century. Since the 1950s the Dutch fleet witnessed a gradual ending of this laissez faire approach, with profound changes in relation to technological developments, international fisheries management, and societal influence.

The last 70 years of change in the Dutch demersal fisheries can be classified in three main periods: the period 1950–1990: the development of (international) top-down management; the period 1990–2005: development of co-management and European stock recovery measures; and the period 2005–2018: development of shared sensemaking via knowledge networks, innovation and stock recovery. In Table 1 below the three periods of change in the Dutch demersal fisheries are discussed on the basis of transition theory and developments in governance. Focus is on the characteristics of the role of government, the role of other actors, the development of institutions and practices and the narrative used in the transition by way of sensemaking.

3.2.1. Period 1950–1990: development of top-down management leads to noncompliance

After the Second World War, and particularly since the 1960s, the Dutch North Sea demersal fishing fleet developed rapidly. The growth of the sector "was based... on a technical innovation, the double-beam trawl, which was introduced at the end of the 1950s, and the development of an export market for flatfish. As a result, the Dutch beam trawl fleet increasingly concentrated on flatfish", especially sole and plaice [67 p504]. In the period from 1958 to 1977, Dutch fisheries in the North Sea were managed nationally. Beyond the territorial waters of coastal countries (initially 3 miles, later extended to 12 miles following the London Convention of 1964), fishing was unrestricted and the principle of free access applied.

With the introduction of the 200 nautical mile Exclusive Economic zones (EEZ) and Exclusive Fisheries Zones [11] (in 1977 for the Netherlands), nations had the opportunity to claim the ownership of fish stocks within their Exclusive Economic Zones [68,69]. This de facto meant that the North Sea was shared between its bordering Member States, providing a foundation for North Sea fisheries management [37].

In 1975, the North East Atlantic Fisheries Convention (NEAFC, established in 1964) introduced Total Allowable Catches (TACs) for several species of fish, including sole and plaice in the North Sea, the two most important species for the beam trawl fleet [70]. The Dutch government responded by setting up a system of Individual Quota (IQ) for the fishers. The IQs were distributed based on historic rights, and could not be sold, leased, or used as collateral [71]. With the introduction of the IQ system, The Netherlands also opened a decommissioning scheme, as a strong tension between the catch capacity and the available quota became manifest. Soon thereafter this resulted in the development of a grey market: once the quota for sole and plaice had been exhausted, these species were often still landed but now registered as 'sea fish' (non-quota species) [4].

Table 1
Transition characterisation of three periods of development in Dutch demersal fisheries, 1950s marking the first period.

Period	Characteristic	Role of government	Role of other actors	Development of institutions and practices	Type of sensemaking
Prior to 1950s	*Laissez faire*	Basic access regulations (e.g., permits)	Fishers experience significant freedom (e.g., no quota apply)	Fisheries Act 1857 centralises fisheries regulations	Individual sensemaking: mainly fishers and fishing companies set the narrative within basic boundaries set by government
1950 – 1990	Development of top-down management	Development of fisheries management measures and fisheries management institutions	Fishers increasingly are being subject of fisheries management. Fishers remain outside of shaping policy	Introduction of fisheries management institutions. Fisheries practices develop towards full commercial activity	Individual sensemaking: Government sets the narrative. Transition from fisheries expansion to stock based fisheries limitation.
1990 – 2005	Development of co-management	Adjusting fisheries management, inclusion of industry in fisheries management	Fishers included in fisheries policy making and implementation. Other actors remain outside of the fisheries management arena	Fisheries management institutions opening up to include fishers. Increasingly fisheries management develops from a national issue to an EU practice	Joint sensemaking: Increased stock based fisheries management. Gradual introduction of wider marine management and ecosystem management. Development of an EU narrative of fisheries management.
2005 – 2018	Development of shared sensemaking	Opening up the discourse of fisheries and marine management to include other stakeholders and develop joint perspectives. EU policies drive national fisheries policies. Ecosystem objectives drive marine management	Other stakeholders included in fisheries and marine policy making. Development shared objectives. Certification of fishing practices gains influence	Joint policy perspectives developed by government and stakeholders. Fisheries management increasingly being influenced from outside the traditional fisheries management paradigm to include ecosystem and sustainability criteria. Increasingly other stakeholders gain influence on the fisheries management discourse.	Shared sensemaking: At national level joint development of marine management perspectives; including larger perspective of other sectors and stakeholders in to the narrative. Separate development of national and EU level perspectives

The oil crisis of the 1970s lead to a further restructuring of the demersal fleet, as the beam trawl is very fuel intensive. In 1978, a second decommissioning scheme was set up [4]. Ironically, in the same year the EEC's Structural Policy for the fishing fleet (established in 1970) introduced regulations for fleet renewal and the increase of fishing capacity [72]. Some fishing entrepreneurs pointed to public policies as the cause of all the difficulties; in particular, they drew attention to the non-imposition of an engine capacity HP-limitation, tax arrangements and the acceptance of the international quota systems [73]. By 1981, the stimulation of fleet renewal under the European Structural Policy fuelled the further development of a grey market for sole and plaice in The Netherlands.

The year 1983 marked the establishment of a comprehensive EU Common Fisheries Policy (CFP) [10,11]. The new policy added a Conservation Policy to the existing Structural Policy (1970), Market Policy (1970) and Third Countries Policy (1977) [10,11]. The new CFP not only aimed at the implementation of TACs in the context of conservation policy, it also witnessed a transformation of the EU Structural Policy. From now on, this policy aimed at reducing overcapacity in the European fleet. In response, the Dutch fisheries ministry implemented a licensing scheme in 1984 which led to an individual horsepower ceiling for vessels [70].

During the early 1980s the Dutch IQ system developed into a system of individually transferable quotas (ITQs) [74]. In 1985, the transferability of the quota was decoupled from the vessels, which meant that ITQs could be freely traded. A year later, engine capacity for the demersal fleet was limited to a maximum of 2.000HP for each vessel. In 1987, the length of the beam of the beam trawl was limited to a maximum of 12 m [75]. These measures followed a growing political concern about the grey market, i.e., noncompliance with the quota regulations. In order to align fishing effort with allocated TACs a tie-up scheme was established in 1986; the number of days vessels could go fishing became limited. This was followed by a third decommission scheme [4] and the establishment of a days-at-sea regime in 1987 [76].

Despite all these management measures, there were continued reports of illegal fishing, under-reporting of catches, grey and black trade circuits and inadequate policing and enforcement by the Dutch state [77]: it became clear that the national administration was insufficiently equipped to maintain a detailed system for keeping track of Dutch vessel landings in Dutch and foreign ports and enforcement continued to be weak [78]. Those years showed a steady downward trend for the demersal fleet in terms of gross revenue, number of vessels and employment [79]. Catches continued to exceed the national quota and, as a consequence of failure to contain the problem, a political crisis arose in 1990. The Dutch Minister for Agriculture, Nature and Fisheries had to resign from his post. This marked a transition to a new phase in the Dutch demersal fisheries.

3.2.2. Period 1990–2005: co-management and European stock recovery measures

In response to the quota management crisis, former prime minister Biesheuvel was tasked to work on a solution together with the fishing industry and government. Under his guidance, a system of co-management with the fishers was established. Co-management groups became responsible for the management of the quota and the days-at-sea regulation [80].

The aim of the co-management groups was twofold: first, to arrive at an effective and efficient system of quota management that would be supported by the fishers; and second, to improve economic performance within quota restrictions allowing fishers to pool their ITQs and their days at sea. Fishers remained the owners of their ITQs and days at sea, but within the group, they could easily and rapidly buy, sell or lease quotas and days at sea, if they had a shortage or a surplus. In this way, individual fishers gained more short-term flexibility and had more options to react to unexpected events. The quota groups had to submit a "fishing plan" to the Dutch Fish Product Board (a statutory umbrella

organisation for the seafood supply chain), detailing how their members wanted to spread their days at sea and catches over the year [67,80]. If a fisher did not comply, he would not only get a fine, but his excess catches would be subtracted from the total quota pool, thereby penalising his colleagues. This social control mechanism proved to enhance compliance [75]. As part of the quota co-management system, the groups introduced an obligation to land all fish via the auction. Ninety-nine percent of all quota holders became a member of a group, and the group system became an effective way of managing the ITQs within the boundaries of the Dutch TAC allocation [75,81].

When dust settled over the quota management crisis, new problems dawned. Important North Sea fish stocks, such as cod (*Gadus morhua*) and plaice were ascertained to be below sustainable levels due to continuous high fishing mortality in the preceding years. In 2001 emergency measures for cod were introduced for all North Sea fleets. The subsequent EU days-at-sea regulation resulted in the termination of the Dutch national days-at-sea scheme.

The establishment of the Regional Advisory Councils as part of the CFP reform in 2002 [4,82] created potential for stronger involvement of the industry and environmental organisations (eNGOs) in European fisheries management. However, the CFP continued being perceived as top-down, micromanaged legislation [11,82] with little room for active participation.

Around this same period, the relationship between industry and the research community was at an all-time low. Fishers did not agree with the stock assessments for North Sea plaice and sole. They held the fisheries research institute (WMR) responsible for the continuous downward trend in TACs and hence catch opportunities [83]. Also the government had ambiguous feelings towards the scientific advice. In response in 2002, a research cooperation between the fishing industry, WMR and the government was set up. The research collaboration initially focused on increasing understanding among fishers and the government on how stock estimates are being produced. Also, detailed commercial catch data were collected by a group of fishers, and communication between government, research and the fishing industry improved. The fishing industry discovered that fishers could make a difference by supplying data that are important for stock assessments. Researchers also realised that fishers can play an essential role in increasing knowledge of the North Sea. This formed the basis of a thriving and ongoing cooperation between the Dutch demersal fishing industry and WMR, which focusses on improving the knowledge base for fish stock management and on developing more selective fishing methods [83].

In 2004 a recovery plan for North Sea plaice was implemented [4]. TACs, and hence quota, were being reduced. Once again, Dutch fleet capacity was larger than available quota levels. In this same year the fishing industry, government and eNGOs signed a declaration of intent aimed at the development of a sustainable perspective for the North Sea demersal fleet. This enabled the extension of the co-management regime to include self-regulation of engine capacity (which had for many vessels been in excess of registered capacity). Also, it was agreed that industry would seek a constructive dialogue with science and eNGOs. In 2005 a fourth decommissioning scheme was opened to bring the fleet back in balance with the reduced fishing possibilities for plaice [4].

By 2005 the North Sea flatfish sector was again facing a serious financial crisis. The financial value of the ITQs for sole and plaice, which had always been at high levels, had almost evaporated. This had a dramatic impact on the fishing companies' equity. Three interrelated factors influenced the drop in the financial value of the ITQs. First, the decommissioning schemes resulted in under-exploitation of the quota. Second, fishing patterns changed due to high fuel prices and the EU days-at-sea scheme. Third, low fish prices and high fuel costs resulted in low profitability [62,84]. In addition to the financial crisis, the flatfish fleet drew increasing attention of eNGOs, who were not only concerned about the poor status of North Sea stocks caused by overfishing, but specifically pointed to the beam trawl fishery with tickler chains in relation to impacting the seabed and the large amounts of unwanted by-catches produced in particularly the sole fishery. The first Dutch consumer fish guide issued by eNGOs in 2006 listed North Sea plaice and sole as "red species", meaning that consumers were advised not to buy these species. Under eNGO pressure several retailers decided not to sell plaice and sole anymore [4]. The financial and image crisis triggered a new period of transition.

3.2.3. *Period 2005–2019: shared sense-making through knowledge networks and innovation*

In 2005, the Minister of Agriculture, Nature and Food Quality established a Task Force consisting of representatives of government, the Fish Product Board, the main fisheries associations, including processing and trade organisations, research organisations and eNGOs. The Task Force was tasked to develop an economic and ecologically sustainable future perspective for the demersal North Sea fleet. Its advice, presented in the *Vissen met Tegenwind* report (Fishing with Headwind) [85] heralds a new period of major change. The advice consisted of six key messages: (1) fishing pressure needs to be reduced for the benefits of stock development, bottom impacts need to be reduced and fishing has to take place in a more selective way; (2) there is no future for the traditional flatfish fishery with beam trawls using chains; (3) societal acceptance is required for a sustainable future and for this a covenant that establishes a road map needs to be agreed between industry, government and eNGOs; (4) cooperation between fishers and societal organisations is essential for a sustainable future; (5) a financial support system is needed to facilitate the transition; and (6) innovative entrepreneurs need a support system in terms of education, financial support and regulations, including the establishment of a Fisheries Innovation Platform with the objective of encouraging a culture of innovation [85].

The Minister subsequently allocated financial resources (45 million euros) to promote innovation of the fishing industry. Part of the funds was used for further fleet restructuring (decommissioning in 2008), part was used for financing (pilot) projects as part of the established Fisheries Innovation Platform, and part was allocated to financing the new Fisher Knowledge Networks in which fishers worked together on solving issues and developing innovations [85].

One of those innovations was the further development of the pulse fishing gear. Sole, the most valuable of the flatfish species, can be targeted year-round and in large quantities, using the beam trawl. As early as 1970, experiments had been carried out with electrical fishing, and in 1986 a Dutch company made first attempts to develop a commercial application, where tickler chains were replaced by electrodes producing electrical currents to startle the fish [4]. In 1988, electrical fishing in marine waters was, however, banned in Europe [2]. In 2004, the Dutch government obtained permission from the European Commission (EC) to carry out practical tests with the pulse trawl on board of a fishing vessel. Convinced by the results of the practical test, five Dutch fishers took up the challenge and started pulse fishing, sharing their experiences in the Knowledge Network Pulse Fishery and hence contributing to the development of a viable gear. This group showed that they had a gear that fishes very well with fewer unwanted by-catches and much lower (fuel) costs, and hence a more profitable business. As a result, the remaining beam trawl fishers also wanted to switch to this gear [4]. In 2006, following advice by the International Council for the Exploration of the Sea (ICES), the EC decided to grant each Member State a derogation to equip 5% of their North Sea fleets with a pulse trawl, provided remaining research questions in the ICES advice were addressed [2]. With a view to further research, including the impending implementation of the EU landing obligation, the Netherlands, with permission from the European Commission, increased the number of pulse derogations in the period in two steps (2010 and 2014) to a total of 76 [64].

In the meantime, the much reduced fishing pressure, combined with more targeted European management of mixed plaice and sole fisheries, resulted in a fully recovered plaice stock [86]. In 2008, a long term EU management plan for North Sea plaice and sole was implemented. In

2009 the first Dutch fishing company received the Marine Stewardship Council (MSC) certificate for sustainable and well-managed fisheries for plaice. In April 2010, a second Dutch plaice company was MSC certified. Overtime many more Dutch fisheries were certified [87] resulting by 2019 in a situation where all plaice fisheries, with the exception of those using pulse trawls, were MSC certified [4].

By 2012, the Dutch demersal fleet showed a positive net result. In fact over the 2011–2016 period there was an upward trend in net revenues in the demersal fleet, a stabilising of the number of vessels and a modest increase in terms of employment [65]. It appears the Dutch demersal fleet had overcome the crisis of the mid-2000s. But yet another storm appeared on the horizon.

3.3. The challenges of today and tomorrow

In her 2018 vision document on circular food production, the Minister of Agriculture, Nature and Food Quality of the Netherlands summarises the current and future challenges for the Dutch fishing industry: "*Sustainable fisheries requires nature and the economy to be, and remain, in balance with each other. It is more selective, ensures less contact with the seabed, has less undesired bycatch and fewer emissions. Healthy fish stocks are and remain the basis and ensure that fishers can earn a decent living, both now and in future generations. […] Future possibilities for fishing in the North Sea and in coastal and inland waters will be limited by the closure of fishing grounds. This is because space is also needed for the realisation of the Natura 2000 goals and the construction of wind farms. The introduction of the landing obligation and Brexit also play a role. […] This sector needs to contribute to the reduction in greenhouse gases as well. When it comes to waste, the challenge is to limit bycatch and, when it nonetheless occurs, to put this to the most valuable use possible*" [13 p26].

In the short term, the fleet has to face implementation of the EU landing obligation, a ban on pulse fishing and Brexit. In the medium term, it is clear that fishers will have to share the North Sea with an increasing number of new users and uses and deal with loss of fishing grounds due to the development of offshore wind farms and implementation of (new) nature conservation areas. In addition, it will have to respond to the call to develop a circular (sea)food production system. In the longer term, climate change adaptation and the increasing attention for animal welfare requirements in fisheries are challenges to be expected. In the next section the main short to medium term challenges will be examined, both singly as well as their combined impact.

3.3.1. Landing obligation

The EU landing obligation (LO) was launched in 2015. For demersal fisheries, it was phased-in gradually (by species and fishery) from January 2016 onwards. In the past, undersized quota species (juveniles) had to be discarded. Under the LO, fishers are obliged to land all catches of quota species, irrespective of specimen size. Many businesses expect significant short-term negative economic repercussions of the LO due to increased operating costs, decreased income from landings and under-utilisation of quota [88,89].

The actual outcomes of the LO will depend on several factors among which successful development of more selective gears, changes to counter-productive regulations that prevent fishers from using large meshes, costs of landing unwanted catch, prices obtained for unwanted fish, compliance of the sector and enforcement effort by the authorities. For the Dutch demersal beam trawl fleet targeting sole with 80 mm meshes, the LO is a particular challenge as this fishery is associated with substantive levels of discards of particularly plaice and dab (*Limanda limanda*). Application of selectivity measures results in significant losses of valuable sole, while hardly reducing unwanted by-catch of other species [4].

In the short run the Dutch fleet has managed to reduce the impact of the LO. First, following advice by ICES [90], the European Commission decided to take dab out of the quota regime. Consequently, the LO does no longer apply for this species, implying this species can again be discarded. This alleviated on board operations and associated cost of landing all dab, as the vast majority of dab by-catches in North Sea demersal fisheries are unwanted by-catch and are discarded because there is no market for them [91]. Second, the Dutch demersal fisheries managed to get temporary exemptions (2019–2021) from the LO for some species on the basis of survivability of discards, including plaice. An important provision for the exemption for plaice is a pilot on the implementation of a so-called Fully Documented Fisheries scheme, using cameras to register catches. The Dutch fishery advocated this pilot as part of the exemption request. Such so-called Electronic Monitoring schemes are seen as a powerful tool for future fisheries management and, provided they are implemented for supportive rather than enforcing purposes, could contribute to the objectives of the LO [92].

3.3.2. Ban on pulse fishing

Early 2019, following a polarised political debate about the impacts of pulse fishing [93], electric pulse fishing was banned as from July 2021 as part of the revision of the European Technical Measures Regulation. This implies that 76 Dutch vessels (2016) [64] fishing under a derogation of the ban on electric fishing (EU regulation 850/1998) have to revert to other fishing methods. For fishers who have a large sole quota, the only option is to switch back to beam trawling, as there are no viable alternatives at the moment [94]. For fishers who have a large plaice quota (and less sole) regulations and permits to change to available alternative gears (twinrig, fly-shoot) are restricted under national law. In addition, the costs of refitting vessels is substantive [64]. Reverting to beam trawling, means that catch processing time takes much longer due to increased unwanted bycatch of undersized fish and benthos, fuel costs will double, while fish prices for fish caught by beam trawlers are lower than for pulse vessels [85].

The decrease in the financial results due to the ban has three main effects on the economy of the fishing industry: (1) the negative results will jeopardise the continuity of the companies; (2) it will be difficult to maintain qualified crews on board because of lower income (crew is self-employed and work on the basis of a share system) (3) the decrease in the financial result will eventually result in less means being available for replacement and renewal of the vessel and gear. In addition, there will be impacts on the ancillary and processing industry [4,64] and on fishing communities. The majority of pulse fishers whose derogations have been terminated following the ban, are already experiencing these impacts.

3.3.3. Brexit

A Brexit implies that EU fisheries policy will no longer apply to the fishing fleet of the United Kingdom (UK) and British territorial waters (12 nautical miles or 22.2 km) and new agreements must be made about the rights of non-UK fishers to fish in the British territorial waters of the North Sea, the English Channel and the Atlantic Ocean around the UK [95]. These agreements will have to fit in with the new fisheries policy pursued by the British government, which most likely will restrict access to UK waters. If the UK claims the exclusive right to fish its EEZ, which is estimated to contain a substantial part of the EU's fish population [96], it can be expected that a Brexit will have a significant impact on the European fishing industry [97].

The Brexit may have major consequences for the Dutch fishing industry: access to each other's waters will have to be negotiated, import and export duties are possible and (quality) controls will have to be re-established at the borders. As for the Dutch demersal fleet, the share of fishing from British waters varies; about 30% of the catches of the Dutch demersal fleet stems from British waters, with 30–35 vessels depending for more than 50% of their income on the British fishing areas [98].

3.3.4. Area closures: offshore wind farms and nature conservation areas

The Netherlands are planning a large-scale development of offshore wind farms in the North Sea. As part of its climate change strategy, offshore wind production should be at least 11.5 GW in 2030 with

further growth possibilities towards 60 GW by 2050 [99]. Offshore wind farm locations are not accessible for trawl fisheries, which means that fishers will lose access to fishing grounds and will have to relocate. At the same time, fishers will be confronted with restrictions as a result of the implementation of the management plans for nature conservation under European Natura 2000 framework. There are plans to increase the number of designated Natura 2000 areas.

It is expected that these area closures for wind farms and nature conservation will result in a gross revenue loss for the demersal fleet of 7–20% [98]. The displacement of fishing activity might also lead to ecological impacts due to increased fishing activity in areas that have hitherto not or hardly been fished [4].

3.3.5. *Combined impacts*

After several lean years, since 2012 the demersal fleet was making profit again [65]. Normally this would result in a time of innovation and investment in new vessels or equipment needed to make the industry more sustainable. But uncertainties over the future have so far held back investments by fishers [100]. Fishing companies are expecting loss of income due to the combined effects of planned area closures resulting from offshore windfarms, nature conservation areas and the Brexit. At a time when investing in innovations to deal with the challenges of the future is called for, the ban on pulse trawling means leeway to invest in the development of innovative gears is limited.

The North Sea is one of the most intensively used seas in the world and it is getting increasingly crowded with the introduction of new uses and the expansion of existing uses. Fishers have no area-specific rights which makes it difficult to legally substantiate their vested interests in a North Sea that is increasingly seeing area-specific use [98]. The current and future generations of fishers are faced with an uncertain future because of these combined developments and the need to re-invent their fishing operations under new conditions.

The Dutch government recognised that the developments taking place in the North Sea require a reconciliation of different interest and uses. As a result, a North Sea 2030 strategy is under development, which aims to balance nature conservation with sustainable food production and production of renewable energy [101]. As part of this strategy development, the government, environmental organisations and commercial users, including the fishing industry, are seeking to achieve a North Sea Agreement in which agreements are made about resource allocation. This agreement, negotiated by the different relevant ministries, economic users and eNGOs will lay down spatial allocation measures for the Dutch part of the North Sea and will include a transition fund [25].

4. Discussion: 70 years of change and fisheries transitions

The main transition overarching the transition periods in the Dutch demersal fisheries is that of the scale of fisheries governance. Over time fisheries governance changed from a fisheries largely not being restrictively managed and controlled by government, towards a fishery that is strictly managed at national and EU level. This was a gradual transition, also in how government developed and implemented policies. At times triggered by bottom-up innovative practices (e.g. development beam trawl); at times government at the regime level forced a transition towards more sustainable practices by introducing policies and management measures. Initially fisheries were still managed nationally; fisheries mainly taking place in coastal waters or in the international, largely unregulated waters. However, with increased fishing capacity and first signs of fish stocks being overfished, the regime shifted and transitioned towards more concerted international effort to manage fish stocks. At first with the NEAFC and later-on via the CFP at EU level.

Yet each of the underlying three periods is marked by intermediate transitions. The first transition is that of the mode of governance. This changed, at the national level, from top-down to cooperative governance. Following Tukker and Butter (2005) the transition occurred as a result of a rather fatalist approach; there was chaos out of which a transition was needed. The introduction of the quota system at first did not change fishing practices. The fishers continued catching fish as they did and both the administration system of catches at national level, as control effort, could not adjust at the speed required. Also the sensemaking by fishers lagged behind: the idea that stocks were limited and that they could be overfished was at the time not a shared perception.

Originating in a historical period where modernisation and upscaling was stimulated, following the post-war vision of ‘no more hunger’, the transition to limiting growth and managing catches required modifications in fishing practice. Sensemaking by the Dutch government also was not univocal. While government had become aware of the limits to the reproductive capacity of stocks, it at first turned a blind eye to the gross overshooting of quota by the fleet and the existence of a grey market for landed fish. Yet at a certain point this situation was untenable resulting in a political crisis. The Dutch government addressed the issue by devolving responsibility and accountability for quota management to the fishing industry. A crucial aspect of this adjustment was the use of social control, building on institutions and social practices already present in the fishing sector. Institutions and social practices, especially those of government changed from a ‘top down’ mode [102] towards a co-management mode of shared responsibilities.

This transition in the mode of governance was fuelled by concerns on stock developments. For some stocks the system of single stock management, with setting TACs, accompanied with technical measures worked well. However sustainable management of fisheries presented itself as a wicked problem [54,57]: complex, persistent, involving trade-offs and not easily manageable [58]. Over the years single stock management had become regarded as obsolete, in the face of impact of fisheries on the wider ecosystem including managing the bycatch.

During the 1990–2005 period, due to rising oil prices (landscape level) and growing criticism of environmental organisations on the ecological impact of fishing (thus broadening the scope from stock management to impact of fishing), a new challenge was issued to the fisheries sector to adapt. The 2005–2018 period can be classified as a period of joint sensemaking between government, the fishing industry, environmental organisations and the research community. Within the context of co-management of stocks, government and industry are used to work together. What is new in this period is how eNGOs gained a seat at the table and how government, industry and societal organisations came together to create a shared vision. Government took an active role in taking up the necessity of the fishing sector to innovate to address the challenges they were facing. Government, eNGOs and fishing sector together developed a vision of this transition process. In addition the fishing sector together with the scientific community embarked on a process of collaborative research [83] for stock assessment and a series of innovation experiments.

Following Ingram (2018) and Pigford et al. (2018), there was a deliberate effort to stimulate alternative practices (niches) "operating outside established structures, cultures and practices" to generate ideas and practices which can seed "a transformation in the socio-technical regime" [29 p117, 30]. As much as possible government at niche and regime level was supportive for this change of the system, e.g. by funding research and experiments by the fishing fleet. Hence following Tukker and Butter (2005) this period can be characterised as a combination of the individualist approach and sustainability through the market (of which of course the MSC certification is a major example), plus process management by government creating a transition arena through the establishment of Fisher Knowledge Networks. These groups stimulated innovation and provided a platform where actors (fishers in this case) changed institutions [50]. The establishment of these groups is an example of creating a transition arena [21,103] and taking a small wins approach [44,60].

What provided a problem was the context of multi-level governance in which national perceptions and interpretations could differ from those at the EU level [104], and equally interpretations between for

example the European Commission and the European Parliament could differ [38]. The introduction of the LO and the ban on the pulse trawl illustrate this rift at the regime level. National policies and interpretation of EU legislation appear to be at odds with the perceptions of other actors at the EU level. In addition at the level of the landscape, increasingly developments not directly related to fisheries gain impact on fisheries and fisheries management. The LO illustrates the rapid development at the landscape level of the importance of public perception of sustainability of (fisheries) operations.

The development of the pulse fisheries illustrated from the multi-level *transition* perspective that there was a mismatch between innovation at niche level and the sentiments prevailing at the regime level. From the multi-level *governance* perspective there was equally a mismatch between the perceived impact of the fishing technique between actors at national and EU levels. Hence considering the multi-level governance arena in which fisheries operate, this would not only call for a transition approach and innovation framework at the national level, but also at the EU level [2].

An important role in these transitions has been played by fisheries institutions, both at the level of the niche and the regime. It becomes clear that there is a close relation between government policy development and fleet development. Initially built on a vision of growth and expansion and the idea that stocks cannot be overfished, the vision changed, resulting in effort to curtail the impact of fishing. First focussing on stocks, later also taking into regard the impact of fishing on the wider environment and ecosystem. This process of curtailing effort initially took place in a top-down system, developed towards a situation of co-management and in the most recent period, with increased attention for legitimacy of governance, opened up to include eNGOs.

As from the mid-1970s fishing policy is being developed in Europe; national policy is thus now being developed within the framework of international and, later on, EU policy. Recent developments illustrate that in this multi-level governance context of fisheries management, actors at two governance levels have different roles and relations. At the Dutch national level there is a mode of cooperation, joint decision making and vision building. At the EU level the system remains in effect rather detailed, prescriptive and top-down [11]. Both the LO and the ban on the pulse trawl illustrate how the perception and narrative differ between the actors at national and EU level, and, at the EU level between the different institutions.

5. Conclusion

In the Dutch North Sea fisheries significant adjustments have taken place over the past 70 years, with change having installed itself as a permanent phenomenon both in fisheries and in fisheries management. Significant transitions in the Dutch demersal fisheries have stemmed from the introduction of, and changes in fisheries management policies, institutions and practices. Some changes were based on technological transitions of fishing techniques and practices. Other changes due to transitions in markets and marketing practices. The main shift that has taken place is a fundamental change from a scarcely managed and restricted fisheries towards a strictly managed fisheries, not only at national but also at EU level.

The Dutch case illustrates that firstly, it is important to be aware of the roles of the different actors at different levels of governance. Hence to understand that the position and influence of actors may differ at different levels of governance. Secondly, while government can assist, involvement of fishers and the availability of suitable transition arenas are important for the innovation process. And thirdly, collaborative sensemaking, joint-problem definition and long term vision development are essential for the achievement of effective transitions.

When it comes to changes in policy and sustainability of fishing practices, quite often fishers have followed a so-called fatalist approach [39]; refraining from change until there is no more alternative. If we consider the role of government in the change of the Dutch demersal fleet then we see a transition over time in which this role develops from a rather top-down management of the fleet towards a much more cooperative style of management.

Dutch government often applies the hierarchic approach to transition management by becoming a dominant actor to invoke change (Let's put a man on the moon'). The Dutch case has shown that a transition can be stimulated by creating an environment where initiators develop innovations. Although government funding does help to stimulate this process, the responsibility to invest in the transition and to create support and ownership of the transition ultimately lies with the fishing industry. Illustrative is the example of the MSC certification which shows that obtaining certification has been an initiative of individual fishing companies in collaboration with MSC, not a government instigated process. That synergy can be obtained if an entire production and market chain is involved in a transition is illustrated by the certification itself and the development of the Dutch market for certified fish produce. In addition, MSC certification also requires fish stocks to be managed properly. This provides the sector and government with a common cause.

The Dutch transition process can be characterised by engaging in collective sensemaking. By providing policy and vision documents government provides a narrative for necessary change. As such it is a part of Weick's (2006) sensemaking in which government invites the fisheries sector to embark on a process of change. However, following Grin (2012) and Hendriks and Grin (2007), by creating fora such as the Fisher Knowledge Networks the transition mainly focuses on actors who are a priori sympathetic to the idea of the transition, yet the overall trajectory is still within the confines of the existing political discourse with elements of closed preferences, agenda driven and one of control.

Although government can assist innovation by providing funding it remains pivotal that the fishers themselves also invest in the transition and perceive (co-)ownership of the transition process. As such it is regretful that, in the Dutch transition process, the Fish Product Board was dissolved in 2014; the Board at the time was collecting a research levy from all fishers, funds that could be used to co-invest in innovation. Today such a platform is lacking.

Some of the changes in the Dutch fisheries and fisheries management mark a significant transition, a fundamental change in structure, culture and practices [27,28]. And some of these transitions follow Weick's (2006) perception of this process of change from one state to another as a process of order, interruption, and recovery [44,45]. Whereas Weick emphasises the function of sensemaking as a process of, once the transition has taken place, attaching meaning and context to the new situation, in Dutch fisheries management transition, increasingly sensemaking is used as described by Egan (2019) as providing a narrative to induce change.

The Dutch case illustrates that collective sensemaking [51,52] is important. Joint problem definition and long-term vision, developed and supported by government, fishing industry, scientific community and environmental organisations, are essential in navigating 'transition waters', as they constitute a shared view of what to strive for in the long run. Assigning part of the responsibility for managing the resource to the users of the resource (co-management) has contributed to gaining support of the fishing industry for management measures. In addition, social control has proven to be an effective compliance mechanism in the Dutch demersal fisheries.

At the level of the landscape, over time, a shift in playing field took place from the national level to the European scale (and later-on the European regional level). This has resulted in a need to consider wider stakeholder perspectives then only those at the national level. Hence inclusion of a wider group of (EU) stakeholders in the transition process is required. In addition, in this multi-level governance setting there are contrasts in the roles and relations of actors occurring at the different levels, ranging from cooperation, joint decision-making and vision building at the Dutch national level to a more top-down and polarised frame at the level of the EU institutions [10,11,82,105]. Especially when

developing (technological) innovations such as a new fishing technique, the creation of (international) social and political support among the various stakeholders (including other fishers) and institutions is important.

However, uncertainty regarding the future situation contributed to caution in the Dutch demersal fisheries to invest in innovation. Trepidation stemming from developments around the pulse fishing and the landing obligation, in terms of fisheries policy as well as in public perception. Main fear being that an innovation, though nationally approved, will not be accepted EU wide.

From the perspective of social innovation [106–108], the action perspective for policy-driven socio-technical transitions in the direction of a circular economy is clearly dependent on the socio-technological context. In this process of social innovation, government can facilitate the transition through a priori collective sensemaking and creating arenas for experimentation, providing purpose and space for innovation.

CRediT authorship contribution statement

All authors equally participated in the Conceptualisation, Methodology and Empirical descriptions. All authors contributed to both the writing of the original draft and in the review & editing.

Acknowledgements

The research was funded under the Knowledge Base programmes KB-1-1-D-1 and KB-35-006-001 of Wageningen University and Research Centre. We are grateful to the two anonymous reviewers who helped us improve the manuscript. We are also grateful to our colleagues who contributed to the work reflected upon in this paper (in alphabetical order): J. Batsleer, W.H.M. Baltussen, M.A.P.M. van Asseldonk, N.T. Hintzen, S. Kruiderink, A. Mol, P. Molenaar, J.A.E. van Oostenbrugge, F. Quirijns, W.J. Strietman and W. Zaalmink.

References

[1] J. Rotmans, R. Kemp, M. Van Asselt, More evolution than revolution: transition management in public policy, Foresight 3 (1) (2001) 15–31.
[2] T. Haasnoot, M. Kraan, S.R. Bush, Fishing gear transitions: lessons from the Dutch flatfish pulse trawl, ICES J. Mar. Sci. 73 (4) (2016) 1235–1243.
[3] H. Österblom, M. Sissenwine, D. Symes, M. Kadin, T. Daw, C. Folke, Incentives, social-ecological feedbacks and European fisheries, Mar. Policy 35 (5) (2011) 568–574.
[4] F.J. Quirijns, N.A. Steins, B.W. Zaalmink, A. Mol, M. Kraan, W.J. Strietman, M.A. P.Mv Asseldonk, P. Molenaar, J.A.Ev Oostenbrugge, W.H.M. Baltussen, N. T. Hintzen, in: W.M.Ra.W.E. Research (Ed.), Duurzame Noordzee kottervisserij in ontwikkeling; Ervaringen, lessen en bouwstenen, 2019.
[5] R.Q. Grafton, R. Hilborn, L. Ridgeway, D. Squires, M. Williams, S. Garcia, T. Groves, J. Joseph, K. Kelleher, T. Kompas, Positioning fisheries in a changing world, Mar. Policy 32 (4) (2008) 630–634.
[6] M. Salomon, T. Markus, M. Dross, Masterstroke or paper tiger – the reform of the EU' s Common Fisheries Policy, Mar. Policy 47 (2014) 76–84.
[7] T. Markus, Towards sustainable fisheries subsidies: entering a new round of reform under the Common Fisheries Policy, Mar. Policy 34 (6) (2010) 1117–1124.
[8] M.F. Quaas, M.T. Stoeven, B. Klauer, T. Petersen, J. Schiller, Windows of opportunity for sustainable fisheries management: the case of Eastern Baltic Cod, Environ. Resour. Econ. 70 (2) (2018) 323–341.
[9] M. Visbeck, U. Kronfeld-Goharani, B. Neumann, W. Rickels, J. Schmidt, E. van Doorn, N. Matz-Lück, K. Ott, M.F. Quaas, Securing blue wealth: the need for a special sustainable development goal for the ocean and coasts, Mar. Policy 48 (2014) 184–191.
[10] K. Seidel, The Common Fisheries Policy: The Struggle for a Sustainable Policy, Office for Official Publications of the European Communities, 2019.
[11] E. Peñas Lado, The Common Fisheries Policy: The Quest for Sustainability, John Wiley & Sons, 2016.
[12] L. van Hoof, Fisheries management, the ecosystem approach, regionalisation and the elephants in the room, Mar. Policy 60 (0) (2015) 20–26.
[13] Ministry of Agriculture Nature and Food Quality of the Netherlands. Agriculture, nature and food: valuable and connected: the Netherlands as a leader in circular agriculture, the Hague, p. 40, 2018.
[14] Ministry of Agriculture Nature and Food Quality of the Netherlands. Realisatieplan Visie LNV; Op weg met nieuw perspectief, the Hague, p. 85, 2019.
[15] R. Van Ginkel, Braving Troubled Waters: Sea Change in a Dutch Fishing Community, Amsterdam University Press,, Amsterdam, 2009.
[16] J. Halbe, C. Pahl-Wostl, A methodological framework to initiate and design transition governance processes, Sustainability 11 (3) (2019) 844.
[17] J. Kooiman, Governing and Governance, Sage Publication,, London, 2003.
[18] J. Kooiman, M. Bavinck, The governance perspective, in: J. Kooiman, M. Bavinck, S. Jentoft, R. Pulin (Eds.), Fish for Life. Interactive Governance for Fisheries, MARE Publication Series Amsterdam University Press, 2005.
[19] E. Shove, G. Walker, Governing transitions in the sustainability of everyday life, Res. Policy 39 (4) (2010) 471–476.
[20] C.M. Hendriks, J. Grin, Contextualizing reflexive governance: the politics of Dutch transitions to sustainability, J. Environ. Policy Plan. 9 (3–4) (2007) 333–350.
[21] J. Grin, The politics of transition governance in Dutch agriculture. Conceptual understanding and implications for transition management, Int. J. Sustain. Dev. 15 (1–2) (2012) 72–89.
[22] K.E. Weick, Enacted sensemaking in crisis situations, J. Manag. Stud. 25 (4) (1988) 305–317.
[23] D. Loorbach, N. Frantzeskaki, F. Avelino, Sustainability transitions research: transforming science and practice for societal change, Annu. Rev. Environ. Resour. 42 (2017) 599–626.
[24] F.W. Geels, Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, Res. Policy 31 (8–9) (2002) 1257–1274.
[25] OFL, Onderhandelaarsakkoord voor de Noordzee -Extra mijlen voor een gezonde Noordzee, Overlegorgaan Fysieke Leefomgeving, 2020.
[26] I. Darnhofer, Socio-technical transitions in farming: key concepts, transition pathways towards sustainability in agriculture, Case Stud. Eur. (2015) 17–31.
[27] D. Loorbach, J. Rotmans, Transition management and strategic niche management, Dutch Research Institute for Transitions, Rotterdam,, The Netherlands, 2010.
[28] P. Kivimaa, W. Boon, S. Hyysalo, L. Klerkx, Towards a typology of intermediaries in sustainability transitions: a systematic review and a research agenda, Res. Policy 48 (4) (2019) 1062–1075.
[29] J. Ingram, Agricultural transition: niche and regime knowledge systems' boundary dynamics, Environ. Innov. Soc. Transit. 26 (2018) 117–135.
[30] A.-A.E. Pigford, G.M. Hickey, L. Klerkx, Beyond agricultural innovation systems? Exploring an agricultural innovation ecosystems approach for niche design and development in sustainability transitions, Agric. Syst. 164 (2018) 116–121.
[31] E.A. Alexander, The effects of legal, normative, and cultural-cognitive institutions on innovation in technology alliances, Manag. Int. Rev. 52 (6) (2012) 791–815.
[32] F. Scott, Institutions and Organizations, Sage Publications,, Thousand Oaks, CA, 1995.
[33] W.R. Scott, Institutions and Organizations: Ideas and Interests, Sage,, 2008.
[34] J. Schot, F.W. Geels, Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy, Technol. Anal. Strateg. Manag. 20 (5) (2008) 537–554.
[35] E.A. Eppel, M.L. Rhodes, Complexity theory and public management: a 'becoming' field, Taylor & Francis,, 2018.
[36] S. Piattoni, Multi-level governance: a historical and conceptual analysis, J. Eur. Integr. 31 (2009) 163–180.
[37] L. van Hoof, Who rules te waves? Governance and new institutional arrangements in Dutch fisheries management in the context of the European Common Fisheries Policy, Environemntal Policy Group, Wageningen University,, Wageningen, 2010.
[38] L. van Hoof, M. Kraan, N.M. Visser, E. Avoyan, J. Batsleer, B. Trapman, Muddying the waters of the landing obligation: how multi-level governance structures can obscure policy implementation. The European Landing Obligation, Springer,, 2019, pp. 179–196.
[39] A. Tukker, M. Butter, Governance of sustainable transitions: about the 4 (0) ways to change the world, J. Clean. Prod. 15 (1) (2005) 94–103.
[40] W. de Haas, C. de Lauwere, S. Van Berkum, M. Pleite, L. van Hoof, Now is the time to get this done? An agenda for governance in the transition towards a circular agriculture WEnR, WEcR, WMR, 2019.
[41] E. Shove, N. Spurling, Sustainable Practices: Social Theory and Climate Change, Sustainable Practices, in: Routledge, Routledge, 2013, pp. 17–30.
[42] R. Beunen, K. Van Assche, M. Duineveld, The search for evolutionary approaches to governance. Evolutionary Governance Theory, Springer,, 2015, pp. 3–17.
[43] R. Beunen, K. Van Assche, M. Duineveld, Evolutionary Governance Theory, Springer,, 2015.
[44] K.E. Weick, Faith, evidence, and action: better guesses in an unknowable world, Organ. Stud. 27 (11) (2006) 1723–1736.
[45] L.D. Introna, On the making of sense in sensemaking: decentred sensemaking in the meshwork of life, Organ. Stud. 40 (5) (2019) 745–764.
[46] K.E. Weick, K.M. Sutcliffe, D. Obstfeld, Organizing and the process of sensemaking, Organ. Sci. 16 (4) (2005) 409–421.
[47] J. Helms Mills, A. Thurlow, A.J. Mills, Making sense of sensemaking: the critical sensemaking approach, Qual. Res. Organ. Manag. Int. J. 5 (2) (2010) 182–195.
[48] M.H. Anderson, How can we know what we think until we see what we said?: A citation and citation context analysis of Karl Weick's The Social Psychology of Organizing, Organ. Stud. 27 (11) (2006) 1675–1692.
[49] M. Egan, Sense-making resource efficiency through "sustainability" reports, J. Bus. Ethics 154 (3) (2019) 797–812.
[50] B. Baez, M.Y. Abolafia, Bureaucratic entrepreneurship and institutional change: a sense-making approach, J. Public Adm. Res. Theory 12 (4) (2002) 525–552.
[51] L.M. Bietti, O. Tilston, A. Bangerter, Storytelling as adaptive collective sensemaking, Top. Cogn. Sci. 11 (4) (2019) 710–732.
[52] S. Ganon-Shilon, C. Schechter, Shared sense-making processes within a national reform implementation: principals' voices, Leadersh. Policy Sch. (2019) 1–28.

[53] W. Leal Filho, J. Platje, W. Gerstlberger, R. Ciegis, J. Kääriä, M. Klavins, L. Kliucininkas, The role of governance in realising the transition towards sustainable societies, J. Clean. Prod. 113 (2016) 755–766.
[54] R. Kemp, D. Loorbach, Governance for sustainability through transition management, in: Open Meeting of Human Dimensions of Global Environmental Change Research Community, Montreal, Canada, 2003.
[55] R. Kemp, S. Parto, R.B. Gibson, Governance for sustainable development: moving from theory to practice, Int. J. Sustain. Dev. 8 (1–2) (2005) 12–30.
[56] E. Cameron, M. Green, Making Sense of Change Management: A Complete Guide to the Models, Tools and Techniques of Organizational Change, Kogan Page Publishers, 2019.
[57] A. Dewulf, C. Termeer, G. Breeman, R. Werkman, Governance capabilities for achieving small wins in wicked policy domains, in: 17th Annual MOPAN Conference 2010, 2010.
[58] S. Jentoft, R. Chuenpagdee, Fisheries and coastal governance as a wicked problem, Mar. Policy 33 (2009) 553–560.
[59] M.E. Jordan, R.C. Kleinsasser, M.F. Roe, Wicked problems: inescapable wickedity, J. Educ. Teach. 40 (4) (2014) 415–430.
[60] C.J. Termeer, A. Dewulf, A small wins framework to overcome the evaluation paradox of governing wicked problems, Policy Soc. 38 (2) (2019) 298–314.
[61] K.E. Weick, Small wins: redefining the scale of social problems, Am. Psychol. 39 (1) (1984) 40–49.
[62] LEI Statistics, Visserij in Cijfers, LEI den Haag, Series.
[63] R. Beukers, De Nederlandse visverwerkende industrie en visgroothandel Economische analyse van de sector, ontwikkelingen en trends, LEI, 2015.
[64] B.W. Zaalmink, G. Hoekstra, A. Mol, W.J., Strietman, Sociaal-economische gevolgen van een totaal verbod van pulsvisserij voor de Nederlandse visserijsector, Wageningen Economic Research, juni 2018, Nota 2018-044, 2018.
[65] WEcR, Wageningen Economic Research, Agrimatie, Totale omvang van de visserijvloot stabiel; geringe toename van aanvoer van vis ⟨https://www.agrimatie.nl/PublicatiePage.aspx?subpubID=2526&themaID=2286&indicatorID=2880&sectorID=2860⟩., 2019.
[66] A. Beaujon, Overzicht der geschiedenis van de Nederlandse zeevisscherijen, E.J. Brill,, Leiden, 1885, p. 347.
[67] W. Dubbink, M. van Vliet, Market regulation versus co-management? Two perspectives on regulating fisheries compared, Mar. Policy 20 (6) (1992) 499–516.
[68] J.L. Andersen, M. Nielsen, E. Lindebo, Economic gains of liberalising access to fishing quotas within the European Union, Mar. Policy 33 (3) (2009) 497–503.
[69] F.T. Christy, Transitions in the management and distribution of international fisheries, Int. Organ. 31 (2) (1977) 235–265.
[70] L. van Hoof, Design or pragmatic evolution: applying ITQs in EU fisheries management, ICES J. Mar. Sci. 70 (2) (2013) 462–470.
[71] W. Smit, Dutch demersal North Sea fisheries: initialallocation of flatfish ITQs, in: R. Shotton (Ed.), Case Studies on the Allocation of Transferable Quota Rights in Fisheries, FAO, Rome, 2001, pp. 15–23. FAO Fisheries Technical Paper. No. 411, 2001.
[72] M. Holden, The Common Fisheries Policy: origin, evaluation and future, Fishing News Books Ltd.,, Oxford, 1994.
[73] LEI, De Nederlandse visserij op de drempel van een nieuw tijdvak. Mededelingen en overdrukken no. 127 april 1975, 1975.
W.P. Davidse, The effects of transferable property rights on the fleet capacity and ownership of harvesting rights in the Dutch Demersal North Sea Fisheries, in: R. Shotton (Ed.), Use of Property Rights in Fisheries Management Proceedings of the FishRights99 Conference, FAO, Freemantle, Western Australia, 2000. FAO Fisheries Technical Paper 404/2, 11–19 November 1999.
[75] D. Langstraat, The economic contribution in policy process, Report/Agricultural Economics ResearchInst.(Netherlands), 1999.
[76] W. van Densen, H. van Overzee, Vijftig jaar visserij en beheer op de Noordzee, Rapport 81 Wettelijke Onderzoekstaken Natuur & MilieuWageningen, 2008.
[77] R. van Ginkel, Between top-down and bottom-up governance: Dutch beam trawl fishermen's engagement with fisheries management, in: T.S. Gray (Ed.), Participation in Fisheries Governance, Springer, Dordrecht, 2005, pp. 119–139.
[78] W. Smit, Common Fishery Policy and National Fisheries Management, Mar. Resour. Econ. 12 (1997) 355–359.
[79] W. Smit, W.P. Davidse, J. de Jager, M.H. Smit, C. Taal, M.O. van Wijk, Visserij in Cijfers 1994. PeriodiekeRapportage 31-94, Landbouw-Economisch Instituut, the Hague, 1995.
[80] L. van Hoof, Co-management: an alternative to enforcement? ICES J. Mar. Sci. 67 (2010) 395–401, https://doi.org/10.1093/icesjms/fsp239.
[81] E. Hoefnagel, B. de Vos, Social and economic consequences of 40 years of Dutch quota management, Mar. Policy 80 (2017) 81–87.
[82] J.L. Hatchard, T.S. Gray, From RACs to advisory councils: lessons from North Sea discourse for the 2014 reform of the European Common Fisheries Policy, Mar. Policy 47 (2014) 87–93.
[83] N.A. Steins, M.L. Kraan, K.J. van der Reijden, F.J. Quirijns, W. van Broekhoven, J. J. Poos, Integrating collaborative research in marine science: Recommendations from an evaluation of evolving science-industry partnerships in Dutch demersal fisheries, Fish. Fish. 2019 (2019) 146–161, https://doi.org/10.1111/faf.12423. November.
[84] C. Taal, M. van Wijk, A. Klok, J. de Wilde, M. Smit, Visserij in Cijfers 2002, LEI, the Hague, 2002.
[85] Task Force Duurzame Noordzeevisserij, Vissen met Tegenwind; Advies Task Force Duurzame Noordzeevisserij, 2006.
[86] ICES, Advice on fishing opportunities, catch, and effort, Greater North Sea ecoregion: Plaice (Pleuronectes platessa) in Subarea 4 (North Sea) and Subdivision 20 (Skagerrak), (Published 8 November 2019), Copenhagen, International Council for the Exploration of the Sea. ⟨https://doi.org/10.17895/ices.advice.5644⟩., 2019.
[87] Marine Stewardship Council, Track a fishery ⟨https://fisheries.msc.org/en/fisheries/⟩., 2019.
[88] H.M. Condie, T.L. Catchpole, A. Grant, The short-term impacts of implementing catch quotas and a discard ban on English North Sea otter trawlers, ICES J. Mar. Sci. 71 (5) (2013) 1266–1276.
[89] A. Hoff, H. Frost, P. Andersen, R. Prellezo, L. Rueda, G. Triantaphyllidis, I. Argyrou, A. Tsikliras, A. Motova, S. Lehuta, Potential economic consequences of the landing obligation. The European Landing Obligation, Springer,, 2019, pp. 109–128.
[90] ICES, EU request on a combined dab and flounder TAC and potential management measures besides catch limits. ICES Special Request Advice Greater North Sea Ecoregions Nr.2017.04, International Council for the Exploration of the Sea, Copenhagen, 2017.
[91] F.J. Quirijns, M.A. Pastoors, Discard Atlas of North Sea fisheries. Wageningen Marine Research, Published by Scheveningen Group,, 2014.
[92] A.T.M. van Helmond, L.O. Mortensen, C.S. Plet-Hansen, C. Ulrich, C.L. Needle, D. Oesterwind, L. Kindt-Larsen, T. Catchpole, S. Mangi, C. Zimmermann, H. J. Olesen, N. Bailey, H. Bergsson, J. Dalskov, J. Elson, M. Hosken, L. Peterson, H. McElderry, J. Ruiz, J.P. Pierre, C. Dykstra, J.J. Poos, Electronic monitoring in fisheries: Lessons from global experiences and future opportunities, Fish Fish. (2019).
[93] M. Kraan, R. Groeneveld, A. Pauwelussen, T. Haasnoot, S.R. Bush, Science, subsidies and the politics of the pulse trawl ban in the European Union, Mar. Policy 118 (2020), 103975. ⟨https://doi.org/10.1016/j.marpol.2020⟩.
[94] P. Molenaar, Gear alternatives after European restrictions on North Sea pulse-trawl fisheries. Factsheet,, Wageningen Marine Research,, IJmuiden, the Netherlands, 2019.
[95] S. van Berkum, I. Terluin, Brexit: verkenning van de gevolgen voor de Nederlandse agrosector, LEI Wageningen UR, 2016.
[96] I. MurrayR. Broomfield, Cutting the Gordian Knot, A Road Map for British exit from the European Union, London, Institute of Economic Affairs, 2014.
[97] European Parliament, Research for PECH Committee - Common Fisheries Policy and BREXIT, Directorate-General for Internal Policies; Policy Department for Structural and Cohesion Policies; Fisheries, Brussels, 2017.
[98] A. Mol, B. Zaalmink, N. Steins, M. Kraan, Vissen bij wisselend tij: een notitie over de (cumulatieve) sociaaleconomische effecten van ontwikkelingen die invloed hebben op de Nederlandse kottervisserij, Wagening. Econ. Res. (2019).
[99] Ministerie van Economische Zaken en Klimaat, Klimaatakkoord, 28 juni 2018, Den Haag, 2018.
[100] M. Turenhout, K. Hamon, N. Hintzen, K. Poppe, Brexit and the Dutch Fishing Industry, EuroChoices 16 (2) (2017) 24–25.
[101] OFL, Adviesrapport Verkenning Noordzeestrategie 2030. Overlegorgaan Fysieke Leefomgeving, den Haag, 2019.
[102] J. Kooiman, M. Bavinck, S. Jentoft, R. Pulin, Fish for Life: Interactive Governance for Fisheries, in: MARE Publication Series, Amsterdam University Press, 2005.
[103] J. Grin, The politics of transition governance, Conceptual understanding and implications for transition management, 2011.
[104] S.S. Gezelius, J. Raakjær, Making Fisheries Management Work: Implementation of Policies for Sustainable Fishing, Springer Science & Business Media,, 2008.
[105] E. Stokstad, Tensions flare over electric fishing in European waters, Am. Assoc. Adv. Sci. (2018).
[106] B. Bock, Social innovation and sustainability; how to disentangle the buzzword and its application in the field of agriculture and rural development, Stud. Agric. Econ. 114 (2) (2012) 7–63.
[107] G. Mulgan, S. Tucker, A. Rushanara, B. Sanders, Social innovation: what it is, why it matters and how it can be accelerated, Sk. Cent. Soc. Entrep. (2007).
[108] E. Pol, S. Ville, Social innovation: buzz word or enduring term? J. Socio-Econ. 38 (6) (2009) 878–885.