How governance impacts non-timber forest product value chains in Cameroon

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This is a "Post-Print" accepted manuscript, which has been published in "Forest Policy and Economics"

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1. **Introduction and context**

Over the last two decades, studies have highlighted the economic, social and cultural importance of non-timber forest products (NTFPs)\(^1\) in Central Africa\(^2\) (Ingram et al., 2012a, 2012b; Tieguhong and Zwolinski, 2008). Based on data from Cameroon (Ingram, 2014), around a third of NTFPs harvested are estimated as traded. Many of the high value traded NTFPs (Ingram et al., 2012a, Ingram et al., 2012a) form the basis of local, regional and international trade by individual entrepreneurs and small and medium-scale enterprises (SMEs) (Ingram et al., 2012a; Tieguhong et al., 2010; Ndoye and Tieguhong, 2004). Official, systematically collected data about the value of NTFP trade in the region does not exist. Whilst efforts are being made to collect this as part of the Central African Forest Observatory, studies, market data and trade permits indicate that the annual value of the sector is slightly over a billion US$ (Ingram et al., 2012a, 2012b). Many SMEs sell two or more NTFPs often alongside agricultural products, in quantities which provide a significant income (Tieguhong et al., 2009a). Among the highest valued and commercialised NTFPs in six Central African countries are the leaves of two forest vines or vegetables known as okok or eru (*Gnetum africanum* and *Gnetum buchholzianum*) in Cameroon, fumbwa in the DRC, nkumu or mfumbu in Gabon and koko in Congo and the Central African Republic (CAR)

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\(^1\) Products of biological origin from natural modified and managed forested landscapes. They include plants and animals, whole or in part.

\(^2\) Equatorial Guinea, Republic of Congo, Democratic Republic of Congo (DRC), Cameroon, Central African Republic (CAR) and Gabon.
Eight of the most highly commercialised NTFPs in Cameroon provide on average 40% of annual household income for those involved in their chains (Ingram et al., 2012a). In Cameroon, *Gnetum* spp. traders earn on average 1,469 US$ annually, exporters 6,121 US$, and retailers 1,458 US$ (Ingram 2014). However, both species are threatened in Cameroon by over-exploitation, habitat loss and poor or weak governance (Bikoue et al., 2006; Mala, 2008; Ingram, 2013, 2014), a manifestation of which is corruption (de Wasseige et al., 2012, Transparency International 2009).

1.1 The NTFP sector in Cameroon

Trade in many of these NTFPs has occurred for centuries, and appears to have increased in the last thirty years. For example, okok trade involves around 1,885 people and at least 20 SMEs in Cameroon, and in the DRC at least 1,744 people (Ingram et al., 2012a; Ingram et al., 2012c). In the DRC, in 2007, the annual average revenue of okok harvesters was around at 668$ (Awono et al., 2009). van Dijk (1999) estimated that okok sellers can earn a daily wage of around US$ 1.5. Many NTFP are gathered, processed and marketed both by the main ethnic groups as well as minority groups (Tieguhong et al., 2012a; 2009a). Whilst men dominate many of the chains and often have customary ownership over tree-based products, comprising 60% of people involved in general (Ingram 2014), women generally are engaged in specific activities such as harvest, processing and retail of ‘women’s’ products (Ingram et al. 2013). Ndoye et al. (1997) showed that 94% of the estimated 1,100 NTFP retailers in 18 major markets in the humid forest zone of Cameroon were female. Inter-African and international trade in NTFPs is also important. The okok trade from Cameroon to Nigeria was at least 3.8 million US$ annually in 2010, with a
tenfold increase in the volume of exports estimated since 1991, involving around 1,885 people and at least 20 SMEs (Ingram et al., 2012a; Ingram et al., 2012c).

1.2 Value chain governance

The processes involved as NTFPs are harvested, processed, sold and used create what is known as a value chain. Taking a chain perspective allows the impacts of governance on the trade of these products to be assessed (Kaplinsky and Morris, 2003). Different stakeholders are typically involved at each stage of the chain: small scale harvesters, traders, transporters, exporters and consumers (Ingram et al., 2012c). NTFP chains operate in a context of increasing urbanization, significant poverty, a difficult business environment and significant corruption (de Wasseige et al., 2012). The Central African Forest Commission (COMIFAC) has emphasized the importance of NTFPs as strategic products in realising its three objectives, to fight poverty, enhance economic development and conserve biodiversity through sustainable development of forest resources.

The provision of a favourable business climate by governments has been seen as a prerequisite for economic growth led by the private sector (Commission for Africa, 2005). The regulatory, institutional and policy framework affects the performance of SMEs (Bonannée et al., 2007). However, despite being regulated in many countries in the region, the political and regulatory framework has been criticised as being haphazardly applied, inconsistent, illogical and largely ineffective in ensuring sustainable trade (Awono et al., 2010; Laird et al., 2010; Molnar et al., 2010; Ndoye and Awono, 2010). To address such issues, COMIFAC’s ‘Sub-regional directives on the sustainable management of NTFP of plant origin in Central Africa’ aim to improve governance. The directives provide member countries with guidelines for including NTFPs in
their national legal frameworks and to stimulate their participatory management, strengthen value chains and regional trade, thus increasing their economic contribution and visibility (FAO, 2010; Ingram et al., 2012a, 2012b; COMIFAC, 2008).

Regulations are however not the only mode of governance for NTFP chains. If and when statutory regulations operate, they are often superimposed by other governance arrangements: customary, voluntary and market-based schemes, rules introduced by projects and programmes and international standards (Ingram, 2014). The configurations of which vary widely per product, chain and country. Plural arrangements can result in conflicting governance regimes, negatively affecting the sustainability of species upon which the chains are based in the long term (Ingram, 2014). A product’s growing economic value is often manifested by increasing corruption, illegal activities and conflicts over ownership and access rights to NTFPs (Foundjem, 2013; Ingram, 2012). In timber chains, illegality (the non-respect of prevailing legal rules) has resulted in unsustainable forest management (Tacconi et al., 2003), increasing poverty by reducing forest resources available to the poor (Cerutti and Tacconi, 2006), and significantly reductions in government revenues (Cerutti et al., 2010). Given the widespread view that improving forest governance is essential to sustainably, equitably and effectively manage competing demands on forest products (Djeukam, 2007; Kozak, 2009; WRI, 2009), knowing the economic and environmental impacts of governance arrangements is essential to provide recommendations for policymakers and practice (Laird et al., 2010; Ndoye et al., 2010) to sustainably govern NTFPs.

Given this context, this paper seeks to answer three questions:

1. What formal, regulatory arrangements govern the okok chain in Cameroon and who are the main stakeholders involved?

2. What are the impacts of these arrangements?
3. What changes should be made to provide a favourable governance framework for sustainable NTFP trade in Cameroon?

2. **Conceptual framework**

Links between governance, sustainable development and poverty alleviation were made at the 1997 International Conference on Governance for Sustainable Growth and Equity and subsequently to forests (Kaimowitz, 2003; Ros-Tonen and Kusters, 2011). Practical challenges in realising forest conservation and development goals, have increasingly highlighted that governance plays a critical role in the sustainable management of forests and their products (Tacconi et al., 2003). How forests and their products are governed can have far reaching resource related outcomes, depending on who governs, why, the rights and rules, which have implications for the sustainability of livelihoods (Laird et al., 2009; Mayers and Vermeulen, 2002). Sachs *et al.* (2004) see governance as one of the problems creating and maintaining poverty. They contend that tropical Africa’s poverty trap means it is too poor to achieve robust, high levels of economic growth and, in many places, simply too poor to grow at all. Policy and governance reform alone are deemed insufficient to overcome this trap.

Over the past five decades, many of the difficulties faced in managing natural resources in Africa have been linked to weaknesses of governance and the absence of an effective state (Commission for Africa, 2005). Governance refers to public, civil society and private interactions initiated to solve societal problems and create opportunities (Kooiman et al., 2008). It is the way a society organises itself to make and implement decisions – achieving mutual understanding, agreement and action and comprises the mechanisms and processes for citizens and groups to articulate their interests mediate their differences and exercise their legal rights and obligations (UNDP 2007).
These definitions emphasise that governance embraces the decisions and processes that define expectations, grant and exercise power\(^3\), and/or verify performance. Good governance as purported by the Commission for Africa (2005) is the ability of government and public services to create an economic, social and legal framework that will encourage economic growth and allow poor people to participate in it. Institutionalised corruption, euphemistically called ‘informal taxes’ in Cameroon, it is a manifestation of a lack of respect of both the corrupter and corrupted for (formal and informal) rules governing their interactions. It has been seen as a failure of ‘good’ governance (Kaufmann et al., 2010) and a cause of poverty (Harford, 2006). Defined as the exercise of power for private gain, corruption ranges from additional payments ‘to get things done’ in business to elites engaging in state and power capture. In Cameroon corruption persists despite anti-corruption campaigns in forestry and state affairs, at the behest of international institutions (Topa et al., 2009), or elites wishing to reorient systems to ensure continued personal gain (Cerutti et al., 2013). When nested within formal institutional statutory structures and customary institutions, run in parallel by the same governors, it forms a pluralist layer in the governance of forest resources. Where formal regulations are unknown, unclear or unenforced, corruption can occur. Corruption is often expected, although unpredictably applied, impacting how, when and where transactions occur in value chains and their costs. Most corruption in Cameroonian forest product chains occurs when in accessing markets (transport to markets and ports, and obtaining market places) and accessing resources (obtaining land titles, permits and waybills) (Ingram et al., 2015). The costs of bribery can therefore been taken as a proxy for corruption (Philips, 2006).

\(^3\) Power is defined as the possession of control, authority or influence over others and the ability to enforce wishes when opposed, including when livelihoods are threatened.
Institutions are the formal and informal norms, rules, procedures and processes defining how individuals interrelate, act and make decisions within and outside of organisations. Institutions may not be clearly defined or static in terms of time or space, can be formal or informal and are interlinked with issues of knowledge, power and control. Leach et al. (1999) emphasise that informal institutions are upheld by socially shared usually unwritten rules, created and enforced among the stakeholders involved (Arnold and Ruis Pérez, 2001). The relationships and interactions between the system that is governed and the governance arrangements affects the natural system and setting limits to resource users’ potential (Kooiman and Bavinck, 2005). Variables affecting the impacts of governance are summarised in Figure 1. These principles provide a framework for analysing governance arrangements in NTFP value chains.

3. Methodology

Literature was reviewed to identify the NTFPs most affected by the practices of state agents enforcing regulations on their transportation and trade and to understand the regulatory framework concerning NTFP exploitation, use and trade in Cameroon and in the COMIFAC region. The okok chain was selected as a case due to its high economic, social and environmental value – both in Cameroon and in other Central African countries (Ingram et al., 2012a). A policy analysis was conducted to assess the influence of regulations on trade and in the light of the COMIFAC guidelines on the sustainable management of NTFPs of plant origin (COMIFAC, 2008). Interviews were conducted with government staff, NGOs, international development organisations, and enterprises in the period 2009 to 2013 as part of four consultation sessions concerning the revision of the forestry law on NTFPs. Both the literature (Ingram et al., 2012c;
Interviews were held with 45 traders in Cameroon in 2010 to establish the 10 most important commercialised NTFPs. Okok was stated as the most important, confirming the literature review and justifying its selection for this study. Of these traders, 12 small and medium enterprises trading in okok agreed to participate in the survey, upon the understanding that recommendations to improve the sector would be passed onto decision-makers. Data was collected at road-side check-points and barriers along the two main roads used to transport okok from one of the major production zones around Sa’a, north of Yaoundé in the Centre region, to the main export port of Ideneau in Southwest region, near the Nigerian border, a distance of over 500 km. Semi-structured questionnaires guided interviews with traders, asking about the value chain, stakeholders, and how the chain is governed: the regulations, routes used, the agents stopping vehicles for controls. Corruption was measured by ascertaining costs incurred at every check-point or barrier and to which type of agent payments were made, the location of the transaction, whether receipts were issued, the volume of okok transported on each trip, the purchase and selling prices and product spoilage en route and the perceived impacts on their trade. Traders were accompanied every two days for a period of 26 weeks. Of the 12 traders, six were active throughout the year, three for 26 weeks and three for 20 weeks. Traders subsequently recorded this information themselves for the following six months using a data collection form. Data were analysed using Microsoft Excel. Recommendations based on this data were discussed with traders and also developed further with direct stakeholders (harvesters, traders, exporters),
government and civil society organisations in the sector, as part of the consultative process to revise the 1994 Forestry and Wildlife Law.

4. Results

The first section summarises the results of the literature review, policy analysis and interviews – providing details of the regulatory framework and the reality of the formal arrangements governing okok trade, answering the first research question. The second section details the results of interviews and data collected on the economic and environmental impacts of the governance arrangements, responding to the second question. Based on the literature and interviews, the third section details recommendations on changes required to create a governance framework that supports sustainable NTFP trade in Cameroon.

4.1 Regulatory framework and stakeholders in NTFP trade

Legislation regarding forests in Central Africa is based upon a forest management model that is centred on timber exploitation. Although national forest codes make reference to NTFPs, they are often considered as secondary or accessory products (COMIFAC, 2008). National strategies defining the political priorities for effective valorisation of NTFP have been non-existent until recently. For example, in 2012 the Cameroonian government and stakeholders finalised a plan to manage and develop NTFP (Ministere des Forets et de la Faune, 2012). In all Central African countries, the state is the main owner of forests and natural resources, setting the rules governing access to NTFP and trade at local and national levels. However customary management of forests and resources continues in many countries and remains particularly prevalent in rural, remote and forested areas (Laird et al., 2010; Sunderland et al., 1998). The Cameroonian 1994 Forestry and
Wildlife Law 94/01 (Art. 20) distinguishes between the permanent forest domain — land permanently allocated to forests and/or wildlife habitats (i.e. protected areas and timber concessions), and the non-permanent forest domain — forested lands that can potentially be allocated to other land uses and can be privately owned. Legislation in most countries has enshrined access to resources in the non-permanent domain through traditional use rights, entitling the local population to consume products collected from the forest. The commercialisation of these products is prohibited by law in several countries, regardless of the vulnerability of the resource. Exceptions are small-scale commercialisation in the DRC and potentially in Cameroon with the proposed revisions to the forestry law. Rights and legal access to commercialise specific NTFP are granted in the form of harvest and exploitation permits, and management conventions for specified areas such as for community and communal forests in Cameroon, Gabon, the Republic of Congo and the DRC.

In Central Africa generally and in Cameroon, the institutional framework is characterized by a multitude of ministries and organisations involved in the NTFP sector. In Cameroon, multiple government agencies govern NTFP trade, including the ministries of forestry and wildlife, livestock, agricultural, enterprises and customs. This lack of institutional leadership, human and financial constraints and effective collaboration between the concerned institutions does not facilitate the development of the sector, despite it being stated as a political priority according to Cameroonian Forest Environment Sector Programme and the COMIFAC Convergence Plan and the Congo Basin Forest Partnership action plan. NTFPs are only briefly mentioned in the elaboration and implementation of poverty reduction policies such as the Poverty Reduction Strategy Document. In 2012 a national action plan for NTFPs was developed with private sector, research, development and civil society organisations (Ministere des Forêts et de la Faune, 2012).
As a result, whilst NTFPs are the subject of numerous conservation projects, they have only recently been targeted by programs and projects promoting sustainable enterprise development.

As in most COMIFAC countries, trade in specific NTFPs is regulated in Cameroon. The main texts are the 1994 Law on Forestry and Wildlife n° 94/01 and a 1995 decree N° 95/53 fixing the modalities of the application of the forestry regime. Every person or organisation intending to commercialise ‘special forestry products’ and other NTFPs first needs to be approved (gré à gré)⁴ by the Ministry of Forestry and Wildlife (MINFOF) in Yaoundé. This approval allows access to the sector and renders the trader legal. To obtain approval, a file of information is required, the fee of which costs 150,000 CFA (333 US$). Traders also reported that additional bribes are commonly needed to obtain progress a dossier through the bureaucratic process and obtain the agreement. The procedures are cumbersome. They involve twelve separate steps and documents⁵, and are highly hierarchical, as approval is required by the Prime Minister. They are costly at around 2.5 to 3 million CFAF (5,555 to 6,666 US$) and time-consuming taking between six to ten months. The system is difficult, particularly for individuals or SMEs located far from the capital, with few political connections, or access to sufficient capital to invest in the approval dossier (Nguenang et al., 2013) or for bribes to obtain the approval. Due to these reasons, the number of approvals has remained low, with on average four granted annually since 2008. As a consequence, NTFPs generate comparatively lower revenues for the state compared to timber or wildlife, damning the image of the sector as unimportant and of low value. The average annual

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⁴ Loi 94, Articles 56(3), 148, 149.
⁵ Individuals need to provide a stamped letter indicating the quantity requested, a curriculum vitae indicating their experience and qualifications, proof of any criminal record, statistics and their registration with the Chamber of Commerce. For ‘moral’ persons or organisations, a stamped letter indicating the quantity and type of NTFP requested, type of business and address of the organisation, a copy of their legal status, statistics and registration with the chamber of commerce, copy of police record, a curriculum vitae of the manager, current and former activities of the organisation, certificate showing social security (CNPS) contributions, evidence of tax payments, documents indicating the area of interest, technical knowledge, attestation of financial capacity, and receipts indicating payment of the 10 CFA per kg regeneration tax for the entire quota has been paid.
value of tax revenues reported by MinFoF in the period 2008 to 2012 was 15,225,292 CFAF (33,834 US$).

Table 1 Special forestry product permits and approvals

In Cameroon there are administrative hurdles to obtain an exploitation permit. After the approval, an exploitation permit is required to access to markets for certain special forestry products (produits forestier spéciaux). A flat-rate regeneration tax of 10 CFA per kg is payable for all special forestry products in Cameroon. A waybill (lettre de voiture) is required for the permit holder to transport NTFPs (Decret 95 article 127(2)), without which they may be subject to fines and imprisonment. To export forest products, article 66 (2) of the 1994 Law additionally requires that traders possess an export authorization, a certificate of origin, a specification sheet, a phytosanitary certificate and proof of payment of a graduated surtax depending on the volume to be exported and the level of processing (MINFOF, 2006). The steps in obtaining legal access to NTFP resources and markets are summarised in Figure 2.

Figure 2 Administrative procedures for trading NTFPs in Cameroon

Whilst not explicit or seemingly intended, a result of the regulatory framework is that it creates differential access to legal trade. The administrative requirements for trade in NTFP are similar to those for exploiting timber sector, even though NTFP exploitation rarely occurs on a similar scale or is of a similar value for individual permit holders. For example, the annual value of fiscal receipts from timber from 2000 to 2005 was 84 million US$ (de Wasseige et al., 2009), and in
2012, tax revenues from timber were 14.4 billion CFA (32 million US$)\textsuperscript{6}. The permitting system is accessible for larger companies and elites with political links, which can be seen in their domination of permits and agreements in the last decade (Ingram, 2014). In contrast, smaller enterprises and community-based organisations, including community forests, have faced major problems and generally not been able to obtain agreements or permits, even when supported by local and international support organisations and NGOs (Nguenang et al., 2013; Ingram, 2014). This difficult, centralised and relatively costly administrative system has resulted in widespread and persistent corruption and illegal transactions in the transportation and trade of high value NTFPs. The statutory system is avoided as the benefits of obtaining permits are not perceived as outweighing time and financial costs, so the majority of traders sell nationally and export without the necessary permits. Some traders are not aware of the statutory permits (Ingram et al., 2012c; Laird et al., 2010; Ndoye and Awono, 2010). Others prefer to operate illegally, as legality does not result in less corruption from forestry or other officials (Foundjem et al., 2013; Ingram et al., 2012c).

4.2 Impacts of governance arrangements on the \textit{Gnetum} spp. value chain

The impacts of the governance arrangements are examined from two angles, economic and environmental.

4.2.1 High administrative and transaction costs

The administrative procedures were seen as cumbersome, leading to high transaction costs in terms of time, financial resources and energy. The number of permits is inversely related to the

\textsuperscript{6} Annual forestry fee (\textit{redevance forestière annuelle, RFA}) 6.5 billion, cutting tax (\textit{taxe d’abattage}), 6 billion and factory tax (\textit{taxe d’entrée à l’usine}) 1.9 billion (pers. com. Abouen, Ministry of Finance, July 2013)
number of SMEs involved in the sector, which forces many to operate illegally. For instance, the number of exploitation permits for special forestry products and approvals delivered by MINFOF have decreased over time, shown in Table 1, despite strong evidence of growing volumes of trade (Betti, 2007; Ingram, 2014; Ndoye and Ruiz Perez, 1997; Ruiz-Pérez et al., 1999). The difficulties of the quota allocation system, obtaining waybills, the short timescales covered by permits and the social ties and power of rent seekers restricts access to permits for all but the most powerful (Tieguhong et al., 2010). Thus most traders operate illegally, and often informality. Social ties to members of the quota allocation committee and to MINFOF officials were reported as critical roles in obtaining quotas. A consequence is that quotas and waybills are allocated to individuals or enterprises not actively participating in the chains, who sell them to SMEs trading in the regulated NTFPs, at prices of up to 500% higher than officially paid for waybills. This represents lost revenue for the government and additional costs for enterprises, with profit gained by a few rent seekers. The practice makes control of harvesting practices un-transparent when the permit holder has no control or knowledge of practices on the ground. Figure 3 shows that the price of waybills increased between 2000 and 2002. This influenced many enterprises to operate illegally. Given that quotas and permits are for a one-year period with taxes payable regardless of the actual quantity exploited and traded, most buyers seek to maximise quantities to lower this fixed cost. The government collects around 60% of the value of the regeneration tax (Betti, 2007).

**Figure 3** Yearly variation in waybill and tax costs in Cameroon

### 4.2.2 The economic costs of corruption
Over the year which okok traders were tracked from the production zone to the port of export, on average, vehicles were held up for five minutes at each of the average 60 check-points from the Sa’a (area of production) to Ideneau (port of export). Of these check points, only 10.6% were legal (indicated by payment to a government agent being accompanied by a receipt), 65.6% were illegal (payment to a government agent without a receipt) and 23.8% had both legal and illegal operations. At each checkpoint several financial transactions took place. A total of 18,368 financial transactions took place within the study period, 83.6% of which were illegal and 18.4% legal. The 12 traders spent a total of 341,250,960 CFA, equivalent to US$ 758,336 on all transactions during this period, 33.5% of the value of which was on illegal transactions (Table 2). Thirteen different types of state agents conducted controls and requested bribes, with MINFOF agents, police, gendarmes and customs officers being the most predominant (Figure 4).

Table 2 Number of transactions and amount spent per route taken and legality status

Figure 4 Proportion of costs of corruption from okok traders per type

4.2.3 Encouraging unsustainable resource management

A 2006 Ministerial decision\(^7\) specified 13 NTFP as ‘Special Forestry Products’ and which are regulated by MINFOF through quotas determined annually by an inter-ministerial committee. The listing and quotas are arbitrary and the logic is unclear. Quotas are allocated for all Special

\(^7\) Décision No 0336/D/MINFoF du 6 Juillet 2006, fixant la liste des produits forestiers spéciaux présentant un intérêt particulier au Cameroun
Forestry Products (except recently *Prunus africana*) without any knowledge of the resource base or inventory, as required by the 1994 Law. Although specified in the 1995 Decree (Article 35) and Article 2 of the 2006 decision, resource inventories have not been implemented for *Gnetum* spp., with only one NTFP, *Prunus africana*, recently inventoried. This is a special case given its Convention on International Trade in Endangered Species of Wild Fauna and Flora listing.

The one year validity of the permit from the date of delivery forces permit holders to exploit resources in any way possible to meet their quotas, even if harvesting is not sustainable (Ndoye *et al.*, 2010; Tieguhong *et al.*, 2010). This is illustrated by 46% of *Gnetum* harvested from the Southwest and Littoral regions being harvested unsustainably: the entire vine is uprooted or the tree supporting the vine felled (Ingram *et al.*, 2012c). This practice inhibits regeneration and increases scarcity. Illegal exploitation was seen as the cause of environmentally unsustainable harvesting practices.

4.2.4 Environmental impacts of corruption

Okok leaves are perishable but if kept in suitable conditions remain saleable for around 10 days. Extreme humidity or dryness results in losses. During transport, on average 428 packets (about 0.4 tons) (standard deviation 278 packets) of leaves deteriorated to an unsaleable condition per trip (on average 5.3% of the quantity transported on a trip). Over the six-month period of study, 36,783 packets (about 37 tons) out of the total of 692,024 packets (around 692 tons) became unsaleable. The traders perceived these losses as an impact of corruption, due to opening and closing of vehicles at each control and due to the additional journey time. Traders reported that to counter such practices the amount purchased and therefore harvested, is routinely higher.
4.3 Recommendations for a enabling regulatory and policy environment for sustainable NTFP trade

Major changes were recommended to create a favourable business environment for sustainable NTFP trade in Cameroon, including:

- Enacting recommendations from the stakeholder consultation process to revise the forestry laws, to reflect the realities and importance of the NTFP sector to those directly involved as harvesters, traders and consumers;
- Creating affordable access to resources and markets through a graduated system of permits and associated fiscal regime, which is based on the nature of the species, its vulnerability to harvesting, the exploitation method, which promotes legality, sustainability and employment;
- Continue campaigns against corruption in the sector, by forestry and other officials, particularly in the permitting process and during transport, and eliminate illicit check points with clear signals made public by monitoring, enforcement and punishment of corrupt agents;
- Introduce procedures to reduce administrative bottlenecks and corruption and stimulate lower cost
- The validity of the exploitation permits needs to be changed, moving towards area based allocation units where specified NTFP are collected in a given area under a management plan – allowing long term, sustainable exploitation and viable businesses.
- The exploitation permit should not be transferred or sold in the form of a waybill and should be accompanied by technical prescriptions related to the exploitation, conservation
and processing of the NTFP with financial obligations that encourage processing and employment within the country.

- More transparent models could either be where MINFOF conducts inventories financed by taxes, or where the trader conducts inventories and develops a management and exploitation plan, according to regulatory guidelines approved by the public forest administration, as occurs in the timber sector.

5. Discussion

The formal arrangements and stakeholders involved in the okok value chain in Cameroon reflect Kooiman et al. (2008)’s work: a multi-stakeholder, plural interplay of governance arrangements with institutions representing divergent perceptions and interests. While regulations, governing institutions and boundaries were known and accepted by traders and transporters, with moral ground as long lived national laws, few of the other institutional design principles were met. This strongly suggests, that the arrangements are ineffective. The lack of monitoring and compliance, of sanctions and enforcement – creates space for the illegal practices (seen as morally unjust) which were found to be common in okok transport and trade. Such normality of illegality is mirrored by other studies of NTFP sector in Cameroon (Foundjem-Tita et al., 2013) and in the region (Djeukam, 2007). Most forest policy reforms in COMIFAC countries have targeted timber sector, focussing on sustainability, legality and informality (Cerutti and Tacconi, 2006; University of Copenhagen, 2012) and the fiscal regime (Betti, 2007; Bigombe, 2004). In contrast, the non-timber sector has been invisible for policy makers, both in terms of its social and economic importance. The legal and institutional framework for NTFP trade in Cameroon,
combined with the pervasiveness of corruption, hinders sustainable development of this important and apparently growing sector.

The study shows the discrepancy between regulations on paper and common practices on the ground, indicating that implementation is a critical variable in the sustainability of NTFP chains. This finding reflects the institutional design principles concerning the need for congruence between rules being adapted to local conditions and having benefits proportional to inputs; that affected parties participate in developing and modifying rules; compliance monitoring with rules by monitors who are accountable to users; that there are sanctions for rule violations; that stakeholders can devise their own (effective) institutions; that such activities are nested into different layers of governance arrangements; and for strong institutional enforcement (Agrawal and Chhatre, 2006; Cox et al., 2010; Ostrom, 1990; Scott, 2001). The lack of participation of in creating the rules, in conflict resolution, and accountability of the state to stakeholders in the chain were all issues raised in the consultative process to revise the law (Awono et al., 2010; FAO, 2010).

The impacts of regulation and corruption in increasing trading costs, supports Kaplinsky and Morris’ (2003) view that governance does indeed “matter” – affecting not just competitiveness but also allowing indirect stakeholders (state officials) to gain strongly at the expense of direct stakeholders (traders and transporters). Moreover, given this ineffective, poor governance setting, the aims of national and regional forestry regulations to ensure poverty reduction, sustainable forest management and trade, are largely impaired. The okok case appears typical in the sector: corruption has been shown to comprise up to 20% of okok traders gross costs (Ndoye et al., 2010), and 37% of exporters’ costs (Ingram et al., 2012c). This study had similar findings, with
corruption accounting for around 32% of all costs. These costs are also born by harvesters, as traders purchase at lower prices to maintain profit margins. High trader costs lead to higher prices passed onto retailers and consumers. Reduced profits were reported to lead to closure or stagnation of some enterprises (Tieguhong et al., 2010). The high costs of regulation and corruption stimulate a vicious circle of illegal trade, which further exacerbates trader’s difficulties in obtaining permits. At the national level another impact is low revenue capture, due to tax evasion and non-collection of fees. This in turn contributes to the perception that the NTFPs sector is of low economic and social importance.

The environmental impacts of regulations are counter to the intention of the 1994 law, which seeks “to achieve the general objectives of forest policy, wildlife and fisheries, in a framework for integrated management ensuring, in a sustained and sustainable way, the conversation and the use of those resources and of different ecosystems” (Art. 1). The ecological sensitivity of NTFPs is highly geographic, species and part specific (Cunningham, 2001; Ticktin, 2004). It is known that the vulnerability of okok, and its regeneration potential, depend on the combination of natural variables and levels of abundance and density related to its preferred ecosystem type and the disturbance thereof; the parts harvested (leaves and stems), the quantity harvested and the harvesting techniques (Ingram, 2014). However, permits are based on actual levels of supply, rather than the current demand based system. A knowledge of the status of the resource is essential to ensure and regulate sustainable exploitation (FAO, 2010). Resource inventories based on scientific and local knowledge and management plans have long been recommended for vulnerable and high value NTFPs prior to exploitation and permitting (ETFRN, 2000; FAO et al., 2001). Although specified in the laws, they have not been implemented for Gnetum spp. Further environmental impacts of inappropriate regulations and corruption include the larger volumes
harvested and possible over-exploitation of the resource in order to cover losses incurred during transport, to meet market demand.

These impacts are important for several reasons. First because poverty in Central Africa has remained prevalent in rural areas, where on average 56% of the population, about 65 million people, live. These people living adjacent to or in forests and are highly dependent on natural resources such as okok, for food and income (Tieguhong and Nkamgnia, 2012; FAO, 2007; Ingram et al., 2011; Tieguhong et al., 2009a). Whilst NTFPs can contribute to poverty alleviation, better access to markets is essential (Tieguhong et al., 2012a; Pfund and Robinson, 2005; Tieguhong and Ndoye, 2006; Tabuna, 2007). A governance regime that supports sustainable chains is critical if NTFPs are to constitute part of a lasting path out of poverty, rather than a short term gain that ultimately, exacerbates the difficulties faced by the poor and rural dwellers in the region (Ingram, 2014).

Secondly, as the importance of the timber sector in the region has decreased due to the economic crisis, fiscal revenues have diminished (Tieguhong et al., 2009b), along with employment and job creation opportunities. Although most COMIFAC member countries have planned or are implementing growth and employment strategies, the NTFP sector is hardly integrated into them (Tieguhong et al., 2012).

Thirdly, the interviews show how many stakeholders have limited options to change regulatory arrangements, except to work illegally, as they until recently they have had little voice in governance arrangements or policymaking. The changes to the regulatory and fiscal regime proposed by the COMIFAC directives (COMIFAC, 2008) and now reiterated in the long
proposed revision to the forestry laws in Cameroon, represent innovations that could create a more enabling environment. These include the clarification of terminologies on NTFP of plant origin and elaborating the potential for differential taxation regimes (FAO, 2010), and the promotion of extending traditional use rights of local communities to commercial rights, justified by the poverty context and to achieve the MGDs (Chomitz et al., 2007). A careful balance between specifying non-threatened NTFPs, taking into account the parts harvested, the sustainability of harvesting practices, the potential of natural stands, the existing and development potential of domestication, and the capacity of the government to support and enforce such changes has been seen as essential (COMIFAC, 2008; FAO, 2010). The okok case illustrates that unsustainable harvesting practices of wild or cultivated NTFPs are real and pertinent issues. However, until both the revised law and its implementing decrees and decisions are enacted, practical application of the consultations, COMIFAC directives and regional harmonisation will remain out of reach.

The recommendations for changes to create a more effective, less corrupt governance arrangements mirror other commentators viewpoints and point towards growing consensus on how the regulatory framework should be not just revised, but also enforced. This includes that permits should to reflect the nature of the species and the exploitation methods while reflecting the impact on sustainability and its vulnerabilities (Tchatat and Ndoye, 2006; Laird et al., 2010). Enacting only the recommendations from consultations and COMIFAC directives may be insufficient: investments in transport infrastructure are also needed, mirroring Sachs and colleagues (2004) recommendations.
6. Conclusions

Approaches to reduce poverty through economic growth have focused on the private sector, particularly small and medium sized enterprises, such as those involved in NTFP chains. The growth and development of such businesses has been seen as an opportunity in reducing rural poverty given a favourable enabling institutional, policy, legal and financial environment (Albu and Griffith, 2005; Kozak, 2009; Macqueen et al., 2008; Tieguhong and Ndoye, 2006). This case study of okok demonstrates that businesses based on NTFPs appear viable despite being burdened by high costs and a disabling legal and institutional context. Their long term environmental sustainability is questionable, with corruption leading to waste and possibly unsustainable access to wild resources.

Improved governance, particularly reducing corruption, could stimulate growth and development for traders and transporters of NTFPs and the ability of the government to enable sustainable trade. The okok value chain highlights that improvements in governance are imperative if the economic impact upon the livelihoods of thousands of people is to be maintained or enhanced to ensure sustainable trade. This study shows the negative economic and environmental impacts of arrangements governing the sector. It illuminates that the negative impacts arise due to the differential power and ability of traders and transporters in the chain to access regulatory systems, and the common practice of corruption, which promotes a vicious circle of illegality and informality. The review of the law and the case shows the lack of transparency and the complexity of regulatory procedures, their arbitrary application and costliness, create further opportunities for corruption. The current illogical and inadequate legal framework hinders legal access to these forests resources and their markets, their sustainable stewardship, and creates a disenabling business environment and diminishes incomes. Corruption also leads to product
spoilage and losses, wasting resources and possibly negatively impacting rural and urban food
security.

By reducing the transaction costs related to NTFP trade by increasing transparency of the
permitting system, by decreasing the number of check points, issuing receipts for payments made
to government agents and instituting deterrent punishments, profits to traders and revenue to
government could increase, stimulating the sector. Hope is offered in this direction by the
COMIFAC directives for the sustainable management of NTFP in Central Africa. Implementing
such a framework implies changes to the political, legislative, fiscal and institutional
arrangements governing the access to the production and commercialisation of NTFPs.

Acknowledgements

Research was conducted as part of a European Commission funded GCP/RAF/408/EC
“Mobilisation and Capacity building of small and medium enterprises in non-timber forest
product chains in Central Africa” (2007-2011) project coordinated by the FAO in collaboration
with CIFOR, SNV and ICRAF. Data from CIFOR’s NTFP databases contributed to the study.
The content of this paper is the sole responsibility of the authors and can in no way be taken to
reflect the views of the European Union. We particularly thank all the traders and stakeholders
interviewed for their collaboration. We are grateful to the two anonymous reviewers and the
editor for their comments.

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Fish abundance, fisheries, fish trade and consumption in sixteenth-century Netherlands as described by Adriaen Coenen

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Abstract

Concern about fisheries impact on marine ecosystems has raised the interest in the reconstruction of the state of marine ecosystems and the nature of the human activities in the past. We present late 16th century information on the occurrence and relative abundance of biota in Dutch coastal and inland waters (50 marine fish, 13 diadromous or freshwater and 4 marine mammal species), as well as a description of the sea fisheries (target species, fishing grounds, gear), fish trade, export, and fish consumption in Holland as documented in the handwritten Fish Book by Adriaen Coenen (1577-1581). The species composition and abundances are compared to published trawl survey data from around 1900 and in the 1990’s. Fish species that have disappeared almost completely, were already rare around 1900 and are characterised by a large body size (rays and sharks, sturgeon, ling), whereas currently abundant species were already abundant in the 16th century. Intensive fisheries for herring occurred near Orkney, Fairhill and Shetland. Coastal and freshwater fisheries provided fresh fish for local as well as export markets, but also provided bait for the massive offshore hook and line fishery for the production of salted cod, which remained largely unnoticed. Dried flatfish were exported to Germany. Consumption of fish and marine invertebrates differed between social classes. Coenen distinguished eight consumer categories, a refinement of the categories ‘rich’ and ‘poor’ used in archaeological studies.

Keywords:

Environmental History, 16th century, North Sea, Marine mammals, Fishing methods, Fish trade

1. Introduction

There is worldwide concern about the adverse impact of fisheries on marine ecosystems in general and on exploited populations in particular (Jackson et al., 2001; Pauly et al., 1998). With the exception of some well-studied species such as cod (Gadus morhua), haddock (Melanogrammus aeglefinus) and plaice (Pleuronectes platessa) (see Eero, 2012; Pope and Macer, 1996; Rijnsdorp and Millner, 1996; Rose, 2004), the time series data on catch and effort needed to assess the level of exploitation
and trends in stock biomass are generally available for only a few decades (FAO, 2011). Since man has been fishing the seas for centuries (Barrett et al., 2004; Hoffman, 2005; Lotze, 2007; Fromentin and Powers, 2005), fish stocks and ecosystems may already have been heavily affected before systematic data collection started. Therefore, it seems worthwhile to investigate whether other sources of information could throw light on the historic developments in fisheries and in the state of fish stocks and marine ecosystems.

The North Sea has been exploited for centuries (Poulsen 2008; Engelhard 2008; Thurstan et al., 2013) and is now one of the most intensively exploited seas (ICES, 2012). Archaeological evidence showed a shift from inland to marine fishing in the 10th century AD (Barrett et al., 2004), although marine fish bones have been found in human settlements dating back to the stone age (Enghoff et al., 2007). In medieval times, extensive drift net fisheries developed for herring, hook and line fisheries targeted large predatory fish such as cod and ling in offshore waters, and bottom trawlers fished for a variety of demersal fish in shallow coastal waters (De Groot, 1984; Poulsen, 2008). The increasing demand in the growing urban centres in the 13th and 14th century led to the transport of fish over long distances while fishermen started to exploit distant waters (Barret et al., 2011). However, local fishermen also supplied fish to the growing towns (Ervynck et al, 2004). From the 17th century onwards, North Sea herring (Poulsen, 2008) and cod from Iceland and Newfoundland (Boelmans Kranenburg 1979b, Rose, 2007) started to dominate the market. During the 19th century, the fishery expanded in the wake of the industrial revolution, steam-powered vessels replacing sailing vessels (Engelhard, 2008; Smith, 1994). In the 20th century, fishing pressure further increased as a result of a large array of technological innovations that increased fishing power of individual vessels (Fock, 2014; Lescrauwaet et al., 2010; Kerby et al., 2012; Rijnsdorp et al., 2008).

In trying to put recent developments in fish stocks and ecosystems in a historic perspective, scientists from different disciplines have joined efforts to reconstruct the composition of marine communities before intensive fisheries took their toll using a variety of data sources: such as in the project on the History of Marine Animal Populations (Holm, 2002; Ojaveer and MacKenzie, 2007), data sources used comprise of fish remains in archaeological excavations (Barrett et al., 2011; Enghoff et al., 2007; Lotze, 2007; M ossand Cannon, 2011; Tys and Pieters, 2009; Van Neer et al., 2002; Rose, 2007), analysis of historic archives (Engelhard, 2008; Poulsen,2008; Rose, 2007), analysis of historic photographs (McClenachan,2009); and a combination of data analysis and modelling (Rose,2004).

Another source of information is provided by historic books, such as the ‘Visboeck’ by Adriaen Coenen (Coenensz van Schilperoort, 1577-1581). Adriaen Coenen (1514-1587) was the son of a fisherman from the fishing village of Scheveningen on the coast of Holland, and a self-made naturalist. During his life, in which he worked as fish auctioneer, official beachcomber, and as fish trader, he acquired detailed knowledge about fish species and fishing. In addition to his practical knowledge, he gained access to contemporary literature through acquaintances in the upper class (Egmond, 2005). Combining his own observations with information from local fishermen and fragments from literary sources, he produced three books, two on fish and one on whales. These books comprise essentially
of watercolour images with embedded texts on many aspects of both natural history of the species and their fisheries, as well as text fragments from publications of the ichthyologists Pierre Belon (1555) and Conrad Gessner (1563), the Swedish ecclesiastic Olaus Magnus (1555) and medieval bestiaries. Extensive information on Coenen’s life and his books is given by Egmond et al. (2003) and Egmond (2005). Of the two Fish Books, the one he offered to William of Orange (Prince of Holland) is considered to be lost. The more than 800-page second Fish Book (1577-1581) is the focus of this paper. The Whale Book (1584-1585) is merely an extract from the second Fish Book. In 1585 or 1586, Coenen started with the King of Herring Book but this manuscript remained unfinished.

The objective of this paper is to disclose the information on the fisheries and the state of the North Sea ecosystem in the second half of the 16th century provided by the second Fish Book. As the handwritten text in ‘old Dutch’ is hard to read even for Dutch scientists, we summarize the content in semi-quantitative terms and discuss the information against the current scientific knowledge about the North Sea fish community and the changes in fishing practices, thereby complementing archaeological studies (Pieters et al., 2013) and analysis of historical archives (Poulsen, 2008). The book describes 56 marine and 22 diadromous or freshwater fish species. In addition, information is given on cetaceans, seals and several invertebrates as well as on fishing areas, boats and gears, fish trade, markets and fish consumption. Although Coenen enthusiastically tried to describe the abundance of different species, it is not possible to translate his qualitative data into absolute figures. However, we can compare his broad abundance classes by species with the relative abundance recorded in excavations of fish bones and with trawl survey data to infer changes in species composition since the 16th century. From our viewpoint, the most valuable content lies in Coenen’s own observations rather than in the parts he copied from other sources.

2. Methods and source check

The only copy of the Fish Book is kept in the Koninklijke Bibliotheek (Dutch National Library) in Utrecht, but has been made accessible on the Internet in the form of high resolution images at http://www.kb.nl/bladerboek/visboek/browse/index_1.html (accessed 6-8-2014). Coenen’s own accounts cover folios 23 to 217 (as numerated by the library).

All species descriptions have been checked for 17 aspects concerning names, abundance, fishery, trade and consumption. These species-specific data have been summarized in three tables that were made available online (the hyperlink is provided in the on line supplementary material section). Data of more or less anecdotal nature are presented whenever considered relevant.

Species identification in the Fish Book was based on names, morphological and ecological data, and sizes, and facilitated by the figures or texts from Belon (1555) and Gessner (1563) added to the descriptions. In other cases, old names as available in the online ‘Woordenboek der Nederlandsche taal’ helped to determine the species. However, not all fish could be identified to the species level.
With regard to weevers (*Trachinus draco, Echiichthys vipera*), we assume that Coenen referred to the larger species (*T. draco*), which is a highly appreciated food fish and is commercially exploited.

The identifications were checked against Richter (2006). In several cases, our interpretation is different (e.g. *Pollachius virens*, koolvis in modern Dutch, for *koel*, and *Brosme brosme*, lom for *lommeken*), and missing species were added (see online table about fish). The *kooninck van de harinck* (King of herring) was interpreted as red mullet (*Mullus surmuletus*), in agreement with 10 out of 15 Dutch sources from 1567 till 1900 (Bennema, 2010).

The types of fishing gear and fishing boats were checked against Haalmeijer and Vuik (2007).

The Fish Book presents a lively mixture of early scientific knowledge, medieval fantasies and observations by fishermen and by Coenen himself. Although his citations of unreliable medieval sources could cast doubt on his trustworthiness, there are several arguments to consider his own text as a reliable primary source:

- When his texts on herring and gadid fisheries before 1581 are compared with later studies (after 1600; e.g. Boelmans Kranenburg, 1979a; Poulson, (2008), no dissimilarities are observed, except that Coenen provided additional information.
- Coenen was esteemed as an expert on marine species, who discussed marine life with several aristocrats, including William of Orange (Prince of Holland) and the vice-counsellor of the Leiden University.
- The texts about target species, bait and by-catch contain redundant information, but no inconsistencies were found, which would likely occur if texts were imprecise.
- Coenen was conscientious about naming his sources or referring to own observations.

In order to maintain a critical distance Coenen’s findings were checked against recent literature as much as possible throughout the discussion section.

### 3. Coenen’s account

#### 3.1 Fish

Although Coenen may not provide quantitative data according to our current perception, his descriptions give an impression of the wealth of animal life in the sea, rivers and ponds. On the whole, he was positive about the amount of fish present. Offshore herring (*Clupea harengus*) was the ‘golden mountain of Holland’ and dried plaice (*Pleuronectes platessa*) brought ‘an innumerable amount of money to our country’. Speaking of other commercial fish like cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), salmon (*Salmo salar*) and allis shad (*Alosa alosa*), he repeatedly emphasized the great abundance of these species. Also, the abundance of tasty fish in rivers and ponds repeatedly motivated him to thank God for ‘such a wealth’.
Coenen gave indications about the abundance of 50 marine fish species along the Dutch coast. Fishermen from his village caught fish and shrimps with various kinds of nets as well as long lines at different distances from the shore (Figure 3). The combination of all these fishing techniques should give a good impression of the abundance of most species. Coenen generally started his description of a species with stating whether it was known to local fishermen, and continued with remarks about their abundance. These remarks were used to make a distinction between four categories: absent, very rare (less than once in a year), rare (few per year), (rather) common and plentiful species (Table 1).

Table 1. Fish species in the Fish Book and their abundance. Interpretation (a. absent; vr. very rare (<1 a year); r. rare (< 10 a year); c. (rather) common; p. plentiful) added for comparison. For marine species in 20th century abundance categories based on standardized mean catch rate (number per hour fishing) of trawl survey data (OT20, and mean of GOV and BT8) along Dutch coast (IBTS standard roundfish area 6) copied from Rijnsdorp et al. (1996), +: <=0.05; 1: 0<1; 2: <10; 3: < 100; 4: <1000.

<table>
<thead>
<tr>
<th>Marine fish</th>
<th>“known to fishers of Scheveningen”</th>
<th>Abundance along Dutch coast (Zijde)</th>
<th>Interpretation</th>
<th>1906-1909</th>
<th>1990-1995</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Scyliorhinus canicula</em></td>
<td>Small-spotted catshark</td>
<td>well known</td>
<td>often caught</td>
<td>c.</td>
<td>0</td>
</tr>
<tr>
<td><em>Scyliorhinus stellaris</em></td>
<td>Nursehound</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Galeorhinus galeus</em></td>
<td>Tope shark</td>
<td>well known</td>
<td>very seldom,</td>
<td>vr.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>sometimes one in 5, 6 or 8 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sphyra zygaena</em></td>
<td>Smooth hammerhead</td>
<td></td>
<td>seems to be caught with tope shark</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Mustelus sp.</em></td>
<td>Smooth hounds</td>
<td>well known</td>
<td>often caught in nets and on hook</td>
<td>c.</td>
<td>+</td>
</tr>
<tr>
<td><em>Squalus acanthias</em></td>
<td>Spiny dogfish</td>
<td></td>
<td>not close to the coast but in deeper water</td>
<td>c.</td>
<td>3</td>
</tr>
<tr>
<td><em>Squatina squatina</em></td>
<td>Angelshark</td>
<td>well known</td>
<td>5-6 in a year</td>
<td>r.</td>
<td>0</td>
</tr>
<tr>
<td><em>Torpedo marmorata</em></td>
<td>Marbled electric ray</td>
<td>unknown</td>
<td></td>
<td>a.</td>
<td>0</td>
</tr>
<tr>
<td><em>Torpedo nobiliana</em></td>
<td>Electric ray</td>
<td>not well known</td>
<td>only 1 caught during my lifetime</td>
<td>vr.</td>
<td>0</td>
</tr>
<tr>
<td><em>Dipturus batis</em></td>
<td>Skate</td>
<td>well known</td>
<td>often caught along the coast</td>
<td>c.</td>
<td>0</td>
</tr>
<tr>
<td><em>Raja clavata</em></td>
<td>Thomback ray</td>
<td>very well known</td>
<td>brought to market now that everything is expensive</td>
<td>c.</td>
<td>2</td>
</tr>
<tr>
<td><em>Raja brachyura</em></td>
<td>Blonde ray</td>
<td>very well known</td>
<td>One or two among common rays</td>
<td>c.</td>
<td>0</td>
</tr>
<tr>
<td><em>Raja montagui</em></td>
<td>Spotted ray</td>
<td></td>
<td></td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td><em>Leucoraja naevus?</em></td>
<td>Cuckoo ray</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Species</td>
<td>Common Name</td>
<td>Status</td>
<td>Notes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>--------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Dasyatis pastinaca</em></td>
<td>Common stingray</td>
<td>well known</td>
<td>brought to market now that everything is expensive</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Conger conger</em></td>
<td>Conger</td>
<td>well known</td>
<td>rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Clupea harengus</em></td>
<td>Herring</td>
<td>caught in autumn (slabherring) in C’s youth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sprattus sprattus</em></td>
<td>European sprat</td>
<td>large numbers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sardina pilchardus</em></td>
<td>Pilchard</td>
<td>they migrate along the shore just before slabherring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lampris guttatus</em></td>
<td>Opah</td>
<td>caught once in 1562</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Gadus morhua</em></td>
<td>Cod</td>
<td>well known</td>
<td>plentiful</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Merlangius merlangus</em></td>
<td>Whiting</td>
<td>well known</td>
<td>big amounts</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Melanogrammus aeglefinus</em></td>
<td>Haddock</td>
<td>very well known</td>
<td>plentiful</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Pollachius pollachius</em></td>
<td>Pollack</td>
<td>well known</td>
<td>sometimes one among 1000 cods or one among several 1000s of whiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Pollachius virens</em></td>
<td>Saithe</td>
<td>well known</td>
<td>along 1000 cods sometimes one</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Trisopterus luscus</em></td>
<td>Pouting</td>
<td>well known</td>
<td>along 1000 whiting one</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Molva molva</em></td>
<td>Ling</td>
<td>very well known</td>
<td>sometimes one along several 100s of cod; sometimes 7 or 8 further offshore</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Brosme brosme</em></td>
<td>Tusk</td>
<td>well known</td>
<td>never caught along the coast</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lophius piscatorius</em></td>
<td>Angler</td>
<td>rare, some years positive, some years not</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Chelon labrosus</em></td>
<td>Thicklip grey mullet</td>
<td>well known</td>
<td>sometimes one in half a year</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Belone belone</em></td>
<td>Garfish</td>
<td>well known</td>
<td>one every 6 or 7 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Zeus faber</em></td>
<td>John dory</td>
<td>well known</td>
<td>rarely caught, only 1 or 2 times a year</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Syngnathus acus</em></td>
<td>Greater pipefish</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Taxon</td>
<td>Common Name</td>
<td>Notes</td>
<td>Collected</td>
<td>Captured</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Callionymus lyra</td>
<td>Dragonet</td>
<td>changes in Coenen’s life: In his youth up to 1600 in one trip, then a dip and now better again.</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Chelidonichthys lucerna</td>
<td>Tub gurnard</td>
<td>well known</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Myoxocephalus scorpius</td>
<td>Bull rout</td>
<td>caught with shrimps</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Cyclopterus lumpus</td>
<td>Lumpfish</td>
<td>well known</td>
<td>0</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Dicentrarchus labrax (+ Argyrosoma regius?)</td>
<td>Sea bass (and Meagre)</td>
<td>well known</td>
<td>0</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Myoxocephalus scorpius</td>
<td>Bull rout</td>
<td>caught with shrimps</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Cyclopterus lumpus</td>
<td>Lumpfish</td>
<td>well known</td>
<td>0</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Trachurus trachurus</td>
<td>Atlantic horse mackerel</td>
<td>(Scotland)</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Pagellus sp.</td>
<td>Red / Axillary seabream</td>
<td>very well known, very few caught, some fish 1-3 in May</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mullus surmuletus</td>
<td>Red mullet</td>
<td>(England, Scotland)</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Zoarces viviparus</td>
<td>Viviparous blenny</td>
<td></td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Anarhichas lupus</td>
<td>Wolffish</td>
<td>very well known, sometimes one</td>
<td>0</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Hyperolius lanceolatus</td>
<td>Greater sandeel</td>
<td>sometimes caught with shrimps</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Trachinus draco</td>
<td>Greater weever</td>
<td>well known, plentiful</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Scomber scombrus</td>
<td>Mackerel</td>
<td>5 or 6 in plaice nets in early summer</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Thunnus thynnus</td>
<td>Bluefin tuna</td>
<td>unknown</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Xiphias gladius</td>
<td>Swordfish</td>
<td>Coenen saw 2 in his lifetime</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Scophthalmus maximus</td>
<td>Turbot</td>
<td>well known</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Scophthalmus rhombus</td>
<td>Brill</td>
<td>well known, caught by net with plaice in May and on the hooks</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pleuronectes platessa</td>
<td>Plaice</td>
<td>well known</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Limanda limanda</td>
<td>Dab</td>
<td>by catch with plaice and on hooks</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Platichthys flesus</td>
<td>Flounder</td>
<td>very well known, plentiful</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Common Name</td>
<td>Abundance Inland/ (at sea)</td>
<td>Interpretation 1906-1909</td>
<td>Interpretation 1990-1995</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
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<td>----------------------------</td>
<td>---------------------------</td>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td>Microstomus kitt</td>
<td>Lemon sole</td>
<td>well known</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>along 100,000 dabs</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>sometimes one</td>
<td></td>
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<td></td>
<td></td>
<td>r.</td>
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<td></td>
</tr>
<tr>
<td>Hippoglossus hippoglossus</td>
<td>Halibut</td>
<td>well known</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>cod fishers catch</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>about 1 or 2</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>c.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solea solea</td>
<td>Sole</td>
<td>well known</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>fished for in sole nets</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>c.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mola mola</td>
<td>Ocean sunfish</td>
<td>unknown</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Coenen saw two in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>his life</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>vr.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petromyzon marinus</td>
<td>Sea lamprey</td>
<td>&quot;known to fishers of</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Scheveningen&quot;</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Sometimes on a cod</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>r. at sea</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lampetra fluviatilis</td>
<td>Lamper</td>
<td>Well known</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>plentiful in Maas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Zuid Holland) and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gelderland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p. in rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acipenser sturio</td>
<td>Sturgeon</td>
<td>well known</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Often caught in the</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>North Sea</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. at sea</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alosa alosa</td>
<td>Allis shad</td>
<td>Many in Maas river</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Dordrecht) and IJssel</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>river (Vollenhove)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>p. in rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alosa falax</td>
<td>Twaite shad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osmerus eperlanus</td>
<td>European smelt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>plentiful in rivers and</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>ponds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p. in rivers/fresh w.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coregonus oxyrhinchus</td>
<td>Houting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>big amounts in late</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>summer in Maas river</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>between Dordrecht and</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Geertruidenberg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p. in rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmo salar</td>
<td>Salmon</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Number changed strongly at</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>sea)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Plentiful in inland in</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Maas and IJssel river</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>p. in rivers</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasterosteus aculeatus</td>
<td>Three spined stickleback</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esox lucius</td>
<td>Pike</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rutilus rutilus / Scardinius</td>
<td>Common roach / rudd</td>
<td>plentiful</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>erythrophthalmus</td>
<td></td>
<td>p. in fresh w.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leuciscus idus</td>
<td>Ide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tinca tinca</td>
<td>Tench</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>many</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. in fresh w.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gobio gobio?</td>
<td>Gudgeon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Fish

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Abundance</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common barbel</td>
<td><em>Barbus barbus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common bleak</td>
<td><em>Albumus albumus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver bream</td>
<td><em>Blicca bjoerkna</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common bream</td>
<td><em>Abramis brama</em></td>
<td>in all waters of Holland</td>
<td>c. in fresh w.</td>
</tr>
<tr>
<td>Common carp</td>
<td><em>Cyprinus carpio</em></td>
<td>most important fish of fresh water</td>
<td></td>
</tr>
<tr>
<td>Wels catfish</td>
<td><em>Siluris glanis</em></td>
<td>seldom caught</td>
<td>vr. in fresh w.</td>
</tr>
<tr>
<td>European eel</td>
<td><em>Anguila anguila</em></td>
<td>plentiful</td>
<td>p. in fresh w.</td>
</tr>
<tr>
<td>European perch</td>
<td><em>Perca fluviatilis</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruffe</td>
<td><em>Gymnocephalus cernuus</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Species considered to be plentiful were the commercially exploited species such as herring, cod, haddock, whiting (*Merlangius merlangus*), plaice, flounder (*Platichthys flesus*), dab (*Limanda limanda*) and weever. Among the common species, we find species such as European sardine (*Sardina pilchardus*), tub gurnard (*Chelidonichthys lucerna*), ling (*Molva molva*), turbot (*Scophthalmus maximus*), brill (*Scophthalmus rhombus*) as well as several species of sharks and rays which are regularly caught as by-catch in the fishery for herring, roundfish or flatfish. The species considered common or plentiful are known to occur in (but not necessarily restricted to) shallow waters, except ling. Species to be considered (very) rare comprise of species that mainly occur in offshore waters or are strayers from other areas.

The Fish Book also contains information on fish from brackish and fresh waters (Table 1). Many of these were abundant in rivers and ponds so that fresh water fishery was a source of living. Species that he noted as plentiful were: lampern (*Lampetra fluviatilis*), houting (*Coregonus oxyrinchus*), smelt (*Osmerus eperlanus*), roach/rudd (*Rutilus rutilus/Scardinius erythropthalmus*), tench (*Tinca tinca*), bream (*Abramis brama*) and European eel (*Anguilla anguilla*).

Indications of overfishing, such as the existence of fishing regulations or large variations in catches, can only be found in Coenen’s description of salmon. Salmon were fished intensively on the rivers Maas and IJssel, and to a lesser extent along the shore. ‘Innumerable amounts’ were caught in driftnets and hoop-nets exploited at the river mouth (after the fish had been concentrated by wooden weirs), near Maaslandse Sluis. But *zalmkuilen* (very narrow nets) were forbidden. Although not linking abundance to human activities, he describes a large fluctuation in numbers of salmon over several decades. When his parents were young, salmon were so rare that they had the same value as a sturgeon (*Acipenser sturio*). In his own youth, they were cheap, 1/4 stuiver (nickel) a pound, and in 1578 the price had increased again to 2 to 4 stuiver a pound.

#### 3.2 Marine mammals
Coenen’s description of vast numbers of migrating *potswallen* (sperm whales, *Physeter macrocephalus*) along the shore is almost unimaginable in our time. Once or twice a year, sperm whales migrated from north to south along the Dutch coast. Viewed from his native village Scheveningen, the sea could be full of whales for two or three hours, as far the eye could reach. To convince the reader, Coenen added that William of Orange, Prince of Holland, and Cornelis Suys, President of the court of Holland, once observed the migration near Petten (another coastal village). The Fish Book describes three strandings of sperm whales, including one where a group ran into trouble near the shore, resulting in the death of three individuals.

![Sperm whales](image)

**Figure 1.** Sperm whales (*Physeter macrocephalus*) migrating south along the Dutch shore.

Harbour porpoises (*Phocoena phocoena*) were abundant as well. To the north of Scheveningen, they were caught in porpoise nets that were also used to catch cod. Common bottlenose dolphins (*Tursiops truncatus*) were unknown to the fishermen of Scheveningen but those fishing for herring in the North Sea saw them taking herrings out of their nets. Harbour seals (*Phoca vitulina*) seals were caught at the northern stretch of the coast of Holland, near Petten, and at the isles of Texel and Vlieland.

### 3.3 Fisheries

Fisheries off the Dutch coast targeted mainly on herring, gadids and flatfish. Local fishermen along the sandy coast used flat-bottom boats to fish for flatfish and gadids. Larger boats left from deeper water in the Maas and Scheldt estuary either to fish for herring or for gadids in fishing areas further north, especially near Shetland. Other large fisheries described were those of salmon in the rivers and of herrings in the Zuiderzee, a large inland sea that has been closed off in the 1930s. More specialised fisheries were the catch of bait species to be used in gadid fisheries, and the catch of salmon and shrimps at sea. All these fisheries implemented specialised fishing gear, for example various kinds of hemp nets, hook and line or baskets (Table 2).

### Table 2. Fishing gear, vessel type and their main target species and fishing grounds of Dutch fisheries in the late 16th century as described by Coenen. (* = Coenen does not mention the name pink but other contemporary sources do, e.g. Anonymous, 1514).
<table>
<thead>
<tr>
<th>Fishing gear</th>
<th>Vessel</th>
<th>Target species</th>
<th>Fishing area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift net</td>
<td>buys, boat</td>
<td>herring</td>
<td>North Sea, specially North Scotland, also Norway</td>
</tr>
<tr>
<td>? net</td>
<td>pink (slabbeschip),</td>
<td>herring</td>
<td>coastal waters off Holland (during Coenen’s youth)</td>
</tr>
<tr>
<td></td>
<td>schuitje</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plaice net</td>
<td>pink*</td>
<td>plaice</td>
<td>coastal waters off Holland</td>
</tr>
<tr>
<td>Flounder net</td>
<td>flounder ship</td>
<td></td>
<td>coastal waters of Zeeland</td>
</tr>
<tr>
<td>Sole or narrow net</td>
<td>pink*</td>
<td>sole</td>
<td>coastal waters off Holland</td>
</tr>
<tr>
<td>Salmon net (new &amp; strong)</td>
<td>pink*</td>
<td>salmon</td>
<td>coastal waters off Holland</td>
</tr>
<tr>
<td>Cod net</td>
<td>pink*</td>
<td>cod, haddock, whiting</td>
<td>coastal waters of Holland</td>
</tr>
<tr>
<td>Porpoise net</td>
<td></td>
<td>harbour porpoise</td>
<td>coastal waters of Holland</td>
</tr>
<tr>
<td>Hook and line,</td>
<td>dogger</td>
<td>cod, haddock</td>
<td>northern North Sea</td>
</tr>
<tr>
<td>Hook and line, pole and line</td>
<td>pink*</td>
<td>cod, haddock, whiting</td>
<td>coastal waters of Holland</td>
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<tr>
<td>Beach seine (5-6 men)</td>
<td>-</td>
<td>pilchard</td>
<td>coastal waters of Holland</td>
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<tr>
<td>Drag net (2 men)</td>
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<td>garfish (bait fish)</td>
<td>Marsdiep</td>
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<td></td>
<td></td>
<td>sole, flounder, twaithe</td>
<td>coastal waters of Holland (by laymen)</td>
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<td></td>
<td></td>
<td>shad, salmon, thick tipped</td>
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<td></td>
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<td>grey mullet, mackerel</td>
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<tr>
<td>Baskets</td>
<td>-</td>
<td>lampern (baitfish)</td>
<td>upriver</td>
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<tr>
<td>Drift net &amp; hoop net &amp; weir &amp; seine</td>
<td>-</td>
<td>salmon</td>
<td>mouths of major rivers</td>
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<tr>
<td>Grass shrimp net &amp; drag net</td>
<td>-</td>
<td>Common shrimp</td>
<td>coastal waters of Holland</td>
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</table>

The Dutch herring fishery using 1.4 km long driftnets has been well studied and quantified (Poulson, 2008). Although Coenen does not provide much new data, his account is nonetheless valuable because he describes the less-known period before 1600. He recalled that in his youth fisherman from the coast of Holland fished for *slabharing* in autumn. They used small boats that could be drawn onto the beach (*pinken*) and brought their 6 to 9 lasts (9 to 12 t.) of herring directly to the local market. *Panharing* (that was smoked) was caught in the Zuyderzee from the start of the winter (especially before Christmas) till the second half of March. Slabharing and panharing were hard to conserve and sold fresh or dried, the name of the latter is thought to refer to a frying pan.
Large amounts of herring were caught by French, Flemish, English and Dutch fishermen in the Channel and along the coasts of England, Scotland and Norway. Dutch fishermen fished off Scotland (Orkney, Fairhill and Shetland) using two types of boats, the smaller boeten that could contain 12 to 16 lasts (20 to 27 t fresh weight, Poulson, 2008) and buysen that could contain 20 to 36 lasts (34 to 61 t fresh weight). The season started at Pentecost, some left just before 24 June (St John’s Day) and lasted till All Saints’ Day on 1 November or St Catherine’s Day on 25 November. In this period, they would make 3 to 4 trips in some years and 2 to 3 in others.

Coenen describes that ‘before the great French war’ (in the 1540’s), 200 buysen left from ports along the Maas river (Rotterdam, Delfshaven and Schiedam) not only engaging traditional fishermen but also farmers from the northeast of Holland were engaged on these ships. However, when Coenen wrote his book, most farmers sailed on boats that landed their herrings in Enkhuizen on the Zuiderzee. At the same time an ‘innumerable’ amount of boats left from the fishing villages in the southern province of Zeeland.

Plaice and flounder were caught close to the coast, fishing depth being down to at least two fathoms (3.65m). Although Coenen does not specify the boats used, other sources mention that flatfish were fished by the flat-bottomed pinken and the smaller schuitjes, that could carry only for 2 or 3 men (Anonymous, 1514). Common nets for these fisheries were presumably drag nets.
Fishermen from villages at the sandy coast north of the Maas estuary were referred to as plaice, those to the south as flounder fishermen. Dab, turbot, brill, sole and an occasional lemon sole were essentially a by-catch. When the highly praised sole (*Solea solea*) were abundant, special ‘sole’ or ‘narrow’ nets (with smaller meshes) were used. Plaice arrived in shallow waters in April, when they sometimes aggregated in big masses (*leks*) close to the coast. Fishermen hoped that these ‘leks’ would form in the vicinity of their village. They told Coenen that, although also attracted many boats from other places, it could take 2 to 3 months to deplete them.

Gadids (cod, haddock and whiting) were targeted along the shore by hook and line and by nets employed from the same boats used in the flatfish fishery, but slightly further offshore (Figure 3), while *doggers* used their hook and line as far away as Shetland. The catches taken along the Dutch coast were sold fresh at Dutch and Flemish markets. The offshore (dogger) fishery was conducted by an ‘amazing amount of big boats’ that departed from Holland and Zeeland to fish near Shetland, Fairhill and Orkney, where these species could be found in excess. The men as well as the boats who undertook these four to five-week voyages were called *doggers* or *korvers*. The lines were baited with lampern, allis shad and garfish (*Belone belone*). They came back with casks filled with salted gadids, although the main goal was *aberdaen* (other sources speak of *labberdaan*): salted true cod.

In Scotland, they met with little competition from the local fishermen who, the Dutch fishermen told, fished for *koel* (saithe, *Pollachius virens*) in small boats ‘that were constructed by joining two planks’. This observation matches the local line fishery targeting gadids in the Middle Ages as described by Barret et al. (1999). The description of the boats is probably a misinterpretation of the construction of the Ness yoles, which were built from the broad timbers from Norwegian forests, which permitted the use of a small number of planks (Fenton, 1978).

*Doggers* from Zeeland also went to Helgoland to catch cod, but were apparently less specialized, because they also came back with lobster (*Homarus gammarus*) as part of their catch. The lobsters were sold alive in The Hague and Delft.
3.4 Annual cycle in fishing habits along the coast of Holland (de Zijde)

Coenen’s home-village Scheveningen is exemplary for the fishing villages along the sandy coast of Holland (de Zijde), where fishers managed to secure a year-round income by fishing with hook and line or nets for either cods and for flatfish (Table 3). In early winter, they fished for cod, haddock and whiting (cod: October – Easter), while in February (at Candlemas) many skippers took their *plaice nets* aboard to fish for plaice till June. From June (Pentecost till St John’s Day) till November (All Saints’ Day), the ‘hardy men’ enrolled on boats to fish for herring in Scotland, although the ‘old and easy going’ stayed and fished for sole and weever.

A small group of fishermen fished for salmon along the coast all year round. This required new and strong hemp nets, because the regular hemp nets used for plaice could not withstand the resistance offered by salmon. Only well-to-do fishermen could afford these special nets.

**Table 3.** Annual cycle in the fisheries employed along the sandy coast of Holland (de Zijde).

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<td>slab/herring (old days), pichard</td>
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<td>hardy men 6</td>
</tr>
</tbody>
</table>

1) Start of summer
2) Until Easter
3) Until May (occasional later)
4) Before St John’s day (24 June)
5) Pentecost, some before St John’s day (24 June)
6) All Saints’ Day (1 Nov) or St Catherine’s Day (25 Nov)
7) Until autumn
3.5 Gadid bait trade

The intensive fishery for cod and haddock by Dutch fishermen demanded a large amount of bait. A reordering of the information in the Fish Book reveals a true ‘bait economy’.
Figure 6. Cod economy around 1570 according to Coenen. Trade routes of salted cod from Scotland and fresh cod from the southern North Sea and catch areas of bait species. Whether fishing villages further north on the coast exported fresh cods is unknown.

Doggers leaving for Scotland to catch cod took along three species of fish as bait. The order in which these were employed was first lampen, then salted allis shad, and lastly salted garfish. No information is given whether the lampen were alive, but during later periods they surely were transported alive in special containers (Kranenburg, 1946). Traders from Brielle bought lampers upriver in the province of Gelre (Gelderland) to sell them as bait. Allis shad were caught in the estuary of the Maas river near Dordrecht and Geertruidenberg. Garfish were caught in seine nets in the Marsdiep (the channel between Holland and the isle of Texel). They were salted and put in casks to be sold specially as bait for cod fishing.

Allis shad and lampen were also used to fish for cod along the coast, but three more bait species were used in this fishery: herring, voorn (roch/rudd) and shrimp (Crangon crangon). The herring (panharing) caught in the Zuiderzee during winter was used by coastal fishers during Lent. Shrimps were caught nearby, along the shore. Cod caught using shrimps as bait was believed to be tastier and paid for by the ‘rich and wealthy’, while cod caught with allis shad was considered second best.

Like cod, haddock were caught off the coast using lampen and shrimp. However, Coenen also mentions pekelharing, European sprat and livers of cows and sheep (both fresh and salted). Pekelharing refers to salted herring caught in Scotland. Sprat was taken as a by-catch in the salmon fishery in the Maas river.

3.6 Fish trade

While the herring trade is well documented in the scientific literature, the trade of other species has received much less attention. As a trader, Coenen was in a good position to provide inside information on this less regulated trade. As fish played an important role in the 16th-century economy (De Vries and van der Woude, 1995), it is interesting to look at trade routes and the development of the market.

In Scheveningen, fish was sold to traders through an auctioneer or writer, professions actually practiced by Coenen at some time in his life. His role as a trader can be described as an opportunity seeker. He used to send fish to markets in Belgium, yet at other times he also acted as a middleman for German wholesalers. He explored the market actively, looking out for merchandise as well as buyers. Sometimes, he visited places inland to procure bait for the fishermen of his hometown. At another occasion, he and his colleagues visited the inland town ‘s-Hertogenbosch to explore whether there were enough rich people to buy their merchandise.

The role of wholesalers in the trade of plaice changed during his lifetime. In his youth, German wholesalers went to Antwerp to buy dried plaice. Later on, wholesalers from ‘s-Hertogenbosch and Nijmegen started to buy plaice for the German market in the fishing villages directly. As an example to
give an impression of the volumes involved, the trader Jacob Cornelisen ordered Adriaen Maetz, a
dryer in Katwijk, to deliver 2400 caskets of plaice within one year.

Control of supply chains is illustrated by the lampen trade by Schimmelpenninck, a rich wholesaler
specialized in this product. Schimmelpenninck sold them to fishermen from Zeeland to be used as
bait. He used to take his position in the market by buying large amounts, leading on one occasion to
his bankruptcy. Because of the French war in the 1540’s, fishermen from Zeeland were forbidden to
sail and this left him with his supplies and large claims from his suppliers. After the war his trade
recovered again.

Two other merchants from Brielle actively developed their markets by travelling to Scheveningen to
find new customers. They offered their lampen as bait in exchange for half of the catch. Because the
catch of cod and haddock was higher than ever before, the relatively expensive lampen became the
preferred bait among local fishermen.

3.7 Markets

The ‘rich and wealthy’ were considered to live in cities in Flanders (Antwerp, Mechelen and Brussels)
and Holland (The Hague and Delft). Therefore, these towns were important places for traders to sell
fresh fish such as cod, flounder, halibut (*Hippoglossus hippoglossus*), turbot and sturgeon. Fresh and
salted salmon caught in Dutch rivers were transported to these markets as well.

During Lent, there was a high demand in Flemish cities for ‘fish’-like harbour seals and harbour
porpoise. Remarkably, it was forbidden to sell female harbour porpoise in Antwerp, according to the
rumours because the mayor’s wife had eaten its meat and had become too lustful afterwards. Harbour
porpoise was sent up the river Maas (to Maastricht, Liège and Aachen) and to London as well.

The less fortunate people in Holland visited markets to buy the cheaper fresh sea products like plaice,
flounder and weever as well as blue mussels (*Mytilus edulis*). Also freshwater fish like eel, bream,
smelt and ruffe (*Gymnocephalus cernuus*) were for sale. Some species were also sold on the street by
youngsters: shrimps in The Hague, periwinkles (*Littorina littorea*) in Dordrecht and bleak (*Alburnus
alburnus*) in Zwolle.

Preserved fish was ready for export to surrounding countries. Coenen realized that export of salted
fish was extremely important for the Dutch economy. On two occasions, when writing about the
herring trade and when dealing with the transport of plaice to Germany, he described the export as
“the golden mountain of Holland”.

Dried plaice was transported in casks and baskets over the Rhine to Germany and sold all over the
country. Although Cologne served as the central market, wholesalers from Mainz, Strasbourg and
beyond also came to Holland to buy plaice. During Lent, the demand increased beyond capacity, but
salted plaice and flounder were also acceptable. Although Cologne forbade the import of flounder,
there was an alternative destination: flounder could be sent to the Land of Kleve and Jülich, for the inhabitants of that region ‘did not know flounder from plaice’.

Salted cod (aberdaen) was sent whole (no heads or bones removed) along the Maas to Maastricht, Liège and Aachen, and with the nassen (noses) removed along the Rhine to Cologne because of local rules. Salted mackerel (Scomber scombrus), a by-catch in the herring fishery, were especially favoured in France. The Frenchmen also preferred salted pilchard above salted herring. The harbour of Rouen was the place to transport salted pilchard to.

Dordrecht and Geertruidenberg were important centres for the export of caught in the river Maas (sturgeon, salmon and allis shad) to Flemish cities and, in case of the latter two species, also to Maastricht, Liège and Aachen.

3.8 Consumers

Throughout the Fish Book, Coenen provides information about the taste of different species and about the preferences of those who buy them. Reordering the information leads to a detailed classification of fish consumers:

1. Inedible, mostly thrown back after catch. Most sharks fall in this category, although small-spotted catshark (Scyliorhinus canicula) were appreciated, especially in Zeeland and by fishermen, and also cuttlefish (Sepia officinalis), angler (Lophius piscatorus), common stingray (Dasyatis pastinaca) and European sprat.

2. Poor fishermen: Juvenile smelt, common stingray and smooth hounds (Mustelus sp.). Common stingray was mostly thrown away but eaten by these fishermen when other fish were expensive. In bad weather, they ate skate (Dipturus batis). Smooth hounds was also eaten by trainees on herring boats.

3. Poor people: Salted saithe, thornback ray, angelshark (Squatina squatina), viviparous blenny (Zoarces viviparus) and shore crab. Angelshark was only brought to market when other fish was expensive.

4. Farmers and labourers: Herring, thornback ray (Raja clavata), salted saithe and dried skate. Dried skate was exported to German farmers and ‘workers in mountains and on wine yards’. Coenen was amazed that they would eat ‘this stinking dried skate with their carrots’.

5. Common people: Flounder and plaice (fresh), weever, cod, viviparous blenny, bream and smelt.

6. Everyone. European eel and blue mussels were eaten by both rich and poor.

7. Rich and wealthy: Fresh skate and juvenile rays, dab, sole, cod (especially when caught with common shrimp), the liver of the ling, sturgeon, salmon, harbour porpoise (monks in Belgium), bream, wels catfish (Silurus glanis), gobies, smelt, trout (Salmo trutta), and - at the court in Brussels - lampern. Also, harbour seals, lobster, edible crab (Cancer pagurus) and common
shrimp. Weever came in vogue after Mary of Hungary, the sister of Charles V, ate weever in Scheveningen and expressed that she was delighted.

8. **Skippers and their family and friends.** Wolffish (*Anarhichas lupus*) and tusk (*Brosme brosme*) caught in Scottish waters were considered to be delicate fish, too good for the ‘rich and wealthy’. The skipper preserved them in private casks for own consumption or to give away to family or friends.

4. **Discussion**

4.1 **Marine fish**

The relative abundance of fish species reported by Coenen along the Dutch coast is largely in agreement with the relative abundance of fish bones in the mittens of the 15th century fishing village Raversijde (Pieters et al, 2013) about 100 km southwest of Scheveningen. This collection of more than 50,000 fish bones was dominated by flatfish (41%), gadoids (35%) and clupeids (17%), whereas eels (3%) and rays (2%) were less abundant. Flatfish remains were dominated by plaice 65%, flounder 28%, dab 6% and sole 1%, with brill, turbot and halibut represented 0.2% or less. Within the gadoids, cod predominated, followed by haddock and whiting, and a few pouting (*Trisopterus luscus*) and ling. Clupeids were heavily dominated by herring. European sprat, European pilchard and shads (*Alosa* sp.) occurred far less frequently. Among the rays, the thornback ray was the dominant species followed by spotted ray (*Raja montagui*), sandy ray (*Leucoraja circularis*), undulate ray (*Raja undulata*) and skate. Shark remains were extremely rare (<0.1%) and comprised of smooth hounds, spiny dogfish (*Squalus acanthias*), tope shark (*Galeorhinus galeus*), small-spotted catshark and porbeagle (*Lamna nasus*) (Pieters et al., 2013).

The first quantitative data that are available for comparison originate from the trawl surveys conducted in roughly the same area at the beginning of the 20th century. These data have been analysed and compared to trawl survey data collected between 1990 and 1995 by Rijnsdorp et al. (1996) and the relevant results are included in Table 1. Of course, the relative abundance inferred from Coenen’s account for the Dutch coast is affected by the fishing gear used at that time and by the fishing grounds visited. The main gears used were bottom trawls close to coast and hook and line a bit further offshore (see below). Hence, piscivorous fish were sampled well, but only benthivorous species occurring in shallow waters are represented. In contrast, the 20th century research vessel data refer to beam-trawl (8m – BT8) and bottom-trawl (OT20 or GOV) only. The data should be used with caution due to the use of different gear. To avoid the suggestion of exactness we aggregated the catch rates in powers of ten (Table 1 and Figures 7 and 8).

Moreover, species that have reported only a few times during Coenen’s lifetime refer essentially to strayers from other areas and cannot be considered to form a regular part of the North Sea fish community. These nine species, classified as very rare, have been omitted from the comparison,
because a research vessel survey cannot really be expected to provide reliable data on their occurrence.

Figure 7. 20th century trawl data of table 1 (a: 1906-1909; b. 1990-1995) compared to three 16th century abundance classes by Coenen (horizontal axis). Sizes of circles represent number of species. Dark area’s represent elasmobranches. Number of species is 41.

The comparison with the two sets of research vessel data shows that there is an overall consistency in the abundance classification of the North Sea fish community among the three sources (Figure 7).

Eight species that were plentiful in the 16th century were mostly also abundant (herring, sprat, cod, whiting, plaice) in the 20th century, although the relative abundance may have changed. Greater weever and haddock were recorded in fair numbers in the early 1900’s but declined strongly afterwards. Greater weever was abundant enough to have commercial value both in Coenen’s time
and the first half of the 20th century, but disappeared almost completely from the southern North Sea since the strong winter of 1963 (Daan, 1989).

Of the 23 species that were classified as common for the 16th century 14 species were caught in low numbers (<= 0.05 n.h⁻¹) in the early 20th century catches: small-spotted catshark, smooth hounds, skate, common stingray, blonde ray, sturgeon, pollack (Pollachius pollachius), ling, sea bass (Dicentrarchus labrax), brill, halibut and salmon. One species, spiny dogfish, was caught in relative high numbers (10 n.h⁻¹) at the start of the 20th century but declined in the 20th century to low numbers (<= 0.05 n.h⁻¹) at the end. Eight species occurred in relatively high numbers or very high numbers (dab) in the 20th century trawls. The species that occurred in relatively high numbers were: thornback ray, pouting, turbot, sole, bull rout (Myxocephalus scorpius), tub gurnard and greater sandeel (Hyperolius lanceolatus).

The rare fish along the coast in the 16th century have largely remained rare (e.g. wolffish, conger (Conger conger), halibut, mackerel and angelfish). But for two species this observation needs some refinement, thick lipped mullet (Chelon labrosus) and lumpfish (Cyclopterus lumpus), are rare along sandy coasts, but not in the estuaries.

Most of the very rare fish in the 16th century (e.g. tope shark, electric ray (Torpedo nobiliana), bluefin tuna, opah (Lampris guttatus) are still seldom seen along the coast of Holland (Redeke, 1941; Nijssen & de Groot, 1980) called in surveys (Daan et al 1990) or reported by commercial fishermen (De Voos & van der Meer, 1998). Notable is that also garfish and angler fall in this category. Garfish was not common along the coast but appeared in larger numbers in the Marsdiep, this situation still exists. Angler was probably hard to catch with the fish gear that was used at that time. The fact that bluefin tuna (Thunnus thynnus) was virtually unknown in the 16th century is remarkable in the light of 20th-century bluefin tuna fishing in the North Sea and the association of this tuna with herring (MacKenzie and Myers, 2007).
Figures 8. Average of 20th century trawler data of table 1 compared to three 16th century abundance classes by Coenen (horizontal axis). Graphs for three species size categories (maximum size of species according to Engelhard et al., 2011). Sizes of circles represent the number of species. Dark area’s represent elasmobranches. Number of species is 18, 17 and 6.

It is noteworthy that many of the species that were seldom caught in the 20th century are characterised by a large body size (Fig 8). If we take into account the species that were classified as plentiful or common for the 16th century, all 4 species larger than 2 meter were caught at low numbers (<=0.05) in the 20th century trawl surveys. Of the 15 species between 0.75 and 2 meter 6 (40%) were caught at such low numbers and of the species less than 0.75 m. none were rare in the 20th century surveys. Many of the species that declined strongly were elasmobranchs (smooth hounds, common skate, common stingray, blonde ray (Raja bracyura)) but sturgeon, pollack, saithe and ling may be mentioned as well.

This confers with historical data that reveal that large, valuable fish species were commercialised first, which often led to their depletion (Lotze, 2007; Lotze and Worm, 2009). These large sized species are
characterised by life history traits (late maturation, slow growth rate) that makes them particularly sensitive for increases in fishing mortality rate (Brander, 1981; Jennings et al., 1998).

Within the flatfish fisheries, plaice has remained a dominant target species since medieval times (van Neer et al., 2002, 2004; Rijnsdorp and Millner, 1996). Other flatfish targeted in the 16th century were flounder and sole, whereas turbot and brill were mentioned as important by catch. These species remained commercially important during the 20th century (Kerby et al., 2013), with the exception of flounder, which has decreased in importance owing to the expansion of the trawl fisheries into offshore areas (Smith, 1994; Engelhard, 2008; Kerby et al., 2012) and because of a marked reduction in estuarine habitat (closure of the Zuiderzee and part of the Maas delta). The suggested decline in flounder in Table 1 is likely due to the fact that the 20th century trawl surveys did not cover the estuaries.

Coenen noted that cod and haddock were plentiful and that there were large amounts of whiting. Early in the 20th century, whiting was more abundant than the other two gadid species and has increased its dominance since then (Pope and Macer, 1996). Haddock disappeared from the southern North Sea during the 20th century (Table 1; Bolle et al., 2004; Holm, 2005), but remained a major component of the demersal fish community in the northern North Sea. The abundance of cod has decreased substantially since the 1980s and the stock is considered to be in danger (Pope and Macer, 1996; ICES 2012). The relative abundance of ling, the largest North Sea gadoid species, which was common according Coenen’s account, has declined substantially in the period between 1840 and 1914 (Poulsen et al., 2007) and has maintained itself at a low abundance during the 20th century (Daan et al., 1990).

The only elasmobranchs that were recorded in fairly high numbers in the early 1900’s were spiny dogfish and thornback ray. This corroborates the changes in abundance of elasmobranchs during the 20th century (Walker and Heessen, 1996; Walker and Hislop, 1998; Dulvy et al., 2000; De Oliveira et al., 2013).

Coenen’s observations also document the decline in diadromous species (salmon, sturgeon, smelt, houting, allis shad, twaite shad and European eel ) in or along the North Sea which can be related to the deterioration in their freshwater spawning habitat or the hydraulic engineering works that have created barriers in the upstream migration (De Groot, 1990, 1992).

Already in the Middle Ages a decline of salmon and sturgeon was noticed in the rivers throughout Europe as a result of habitat alteration and fishery pressure (Hoffman, 2005; Lotze, 2005). Asa result salmon fisheries moved from upriver to the river mouths and estuaries (Hoffman, 2005). Salmon catches in the lower Rhine remained high until the end of the 19th century. It was not uncommon for Dutch and German fishermen to land 100,000 salmon a year. Since then, catches started to decline and by 1983 the Dutch salmon fishing industry had virtually ceased to exist. Factors that led to this decline were the increased use of locks and weirs along the Rhine, increase in chemical en thermal
pollution, and the loss of accessible spawning and nursery areas of the required quality (De Groot, 1992).

Fishery for sturgeon in the Rhine river continued after Coenen's time. Their decline set in the beginning of the 20th century leading to extinction as a breeding species in 1942 (De Groot, 1992).

It is clear that Coenen’s ‘superfluous’ sea has nowadays lost part of its richness. In his time common species have diminished in numbers (cod, haddock: Pope and Macer 1996), have become rare (sharks and rays: Walker and Heessen 1996) or have even totally disappeared from Dutch coastal waters (common skate, salmon, sturgeon, houting: De Groot 1990, 1992). Although the above comparison will only give a rough indication, most of the suggested changes in the fish community since the 16th century are in line with the expectations based on life history theory. Some of the larger fish species, which due to their low reproductive rate will be most vulnerable for fishing, had already decreased by the start of the 20th century. The increase in fishing pressure during the 20th century (Engelhard, 2008), which peaked in the period between 1970 and 1990 (ICES, 2012), resulted in a further decline of large, long-lived species relative to small, short-lived species. For species for which the changes in exploitation rate have been estimated since the early 20th century, results show that the stocks were already exploited at a rate well above the rate of natural mortality rate at the start of the time series (Pope and Macer, 1996; Rijnsdorp and Millner, 1996; Burd, 1978; Eero et al., 2007; Godø, 2003).

4.2 Freshwater fish

Coenen emphasized that a great wealth of fish lived in rivers and ponds and that fresh water fishery was a valuable source of living. Thereby, his account supports the conclusion that limited inland fish resources were not the main factor behind the expansion of fishing at sea (Barret et al. 2011). The fresh water fisheries in Holland declined only later as a consequence of salination and the loss of open waters caused by extensive land reclamation projects in the middle of the 17th century (De Vries and van der Woude, 1995). But there were exceptions, such as the catch of vast amounts of salmon along the rivers Rhine and IJssel, which continued till the start of the 20th century (De Groot, 1992).

4.3 Marine mammals

Coenen’s report on seasonal sightings of large groups of migrating whales along the Dutch coast is in sharp contrast to the current situation, where only an odd specimen may be seen in the North Sea. His claim that these groups were formed by sperm whales is not congruent with modern literature. Sperm whales visit the North Sea only occasionally as individual males or in small groups (Camphuysen and Peet, 2006; De Smet, 1981). In the Atlantic only large bulls regularly occur north of about 40°N and these males are not known to form large groups. Probably Coenen misidentified the migrating whales, yet it is not clear which species he observed. In earlier times the North Sea is thought to be inhabited by great numbers of North Atlantic right whales (Eubalaena glacialis) and grey whales (Eschrichtius robustus) (De Smet, 1981; Wolff, 2000). Both species are known to swim close to the coast thus
enhancing the chance that they were spotted from land. But after the Middle Ages their numbers
where low in the North Sea, in the case of the right whale partly because of whaling (De Smet, 1981).
Another candidate is the humpback whale (*Megaptera novaeangliae*) which nowadays occur in
northern Norway and west of the British Isles (Camphuysen and Peet, 2006). This species is often
sighted in different parts of the world as it migrates close to the coast and has a conspicuous
breaching behaviour. While the Fish Book only report strandings of sperm whales his Whale Book is
more elaborate about cetaceans, also reporting strandings of a fin whale (*Balaenoptera physalus*), a
North Atlantic bottlenose whale (*Hyperoodon ampullatus*) and a long-finned pilotwhale (*Globicephala
melas*) (Egmond et al., 2003; Camphuysen and Peet, 2006).

Coenen’s report on seasonal sightings of migrating sperm whales along the Dutch coast is in sharp
contrast to the current situation, where only the odd specimen may be seen in the North Sea. His
description is in agreement with the relatively high number of strandings of large bulls reported in the
period from 1566 to 1788 (Smeenk, 1997; van Deinse, 1918), no longer occur. Coenen’s Whale Book
is more elaborate about cetaceans, reporting strandings of a fin whale (*Balaenoptera physalus*), a
North Atlantic bottlenose whale (*Hyperoodon ampullatus*) and a long-finned pilotwhale (*Globicephala
melas*) (Egmond et al., 2003; Camphuysen and Peet, 2006).

All we know about the harbour porpoises is that their number declined in southern North Sea from
1939 till 1960 and recovered afterwards. The reasons for this fluctuation are unknown (Camphuysen
and Peet, 2006).

Because harbour seals were considered to compete with fishermen, a bounty has been paid for
hunted individuals since the 16th century. From the paid amounts it can be derived that rather large
populations lived in the Waddenzee and the Rhine-Maas-Scheldt estuary (Voors et al. 2012). In the
20th century both populations strongly declined (Reijnders, 1994, Brasseur and Reijnders, 1997).

The grey seal (*Halichoerus grypus*) was not present in the area in Coenen’s time. This species
disappeared in the Middle Ages as the result of overexploitation and disturbance and only returned in
the middle of the 20th century (Reijnders et al, 1995).

4.4 Fisheries

Fisheries along the Dutch and Flemish coast in the early modern period (1500-1800) have been
studied by various Dutch historians (Beaujon 1884; (Boelmans) Kranenburg, 1946, 1979a, 1979b;
Tesch and de Veen, 1933; Van Vliet 1994; De Vries and van der Woude 1995; Van Bochove 2009). Poul sen (2008) studied the Dutch herring fisheries in the period from 1600-1860 landing up to 60,000 t
per year. Most of these studies concentrated on the catch of herring and to a much lesser extent on a
few commercial species like cod and some flatfish or fresh water species. The value of Coenen’s
multispecies fisheries account lies in providing an overall picture.
The seasonal pattern (Table 3) is in agreement with the seasonal pattern inferred from the species composition of fish bones from 15th century mittens of a fishing village at the Flemish coast (Pieters et al., 2013): “fishermen may have had an annual ‘round’ starting in winter with cod, then haddock, then flatfish, and then, in summer and autumn, herring”. A study on annual growth rings in otoliths showed a comparable seasonality, plaice fishing in spring preceded by a haddock fishing season, probably in late winter/early spring (Van Neer et al, 2004). Once again the value of Coenen’s data lay in its completeness, all efforts by different fishermen from the Zijde being included.

During Coenen’s life, the catch of herring started to increase in response to the discovery of a large stock between Scotland and Norway (De Vries and van der Woude, 1995), which would lead to the Dutch domination of these fisheries in the 17th and 18th century (Poulsen, 2008). Already in the 1600s, the herring trade became strongly regulated by the ‘College van de Grote Visserij’ (Boelmans Kranenburg, 1979a; Poulsen 2008). The small fishing villages were not allowed to land or trade gibbed herring any more. It is probably for this reason that Coenen does not provide much new information, but his account is still valuable because he describes the less-known period before 1600. New is his information about the sizes of the boats that sailed to Shetland and Orkney. Sizes still varied strongly, the ideal size of these herring boats had not yet established. (De Vries and van der Woude, 1995). Extensive information and quantified data on the catch of Dutch herring in the North Sea is provided by Poulson (2008).

As an inhabitant of Scheveningen, Coenen paid much attention to the flatfish fishery (Berghahn and Bennema, 2013). Considering the poverty of the coastal fishing villages in recent centuries (Tesch and de Veen, 1933), it is striking to read about the great amount of money earned by selling salted plaice to Germany. Plaice is a dominant flatfish occurring throughout the North Sea down to a depth of about 100m. In the autumn, the adult population migrates to the spawning grounds that are located in the offshore waters of the eastern English Channel and Southern Bight (Harding et al., 1978). After spawning, part of the adults move to coastal waters to resume feeding (Rijnsdorp, 1989), matching Coenen’s report that “in many years the plaice that came from the deep in April, aggregated in big masses close to the coast” (Berghahn and Bennema, 2013).

The Fish Book also pays much attention to the ‘cod economy’, fishery and trade of cods and their bait. Gadids where traditionally caught along the coast but Dutch cod fishers reached the Dogger Bank soon and went to Iceland in the middle of the 17th century (Beaujon, 1884; Tesch and de Veen, 1933; De Vries and van der Woude, 1995; Boelmans Kranenburg 1997b). Coenen fills the gap with his description of cod fishery near Shetland and Orkney. There are indications that Flemish fishermen caught cod in Scotland in the 15th and early 16th century (Ervynck et al. 2004) but this massive Dutch 16th-century cod fishery in Northern Scotland appears to have escaped attention (Boelmans Kranenburg, 1983, Fenton, 1978, Goodland, 1983). Yet there are other records of this fishery. In 1633 captain Smith was send to the Shetland islands to report on fisheries (Smith, 1661). He noted not only about 1500 Dutch busses of 80 t but also about 400 Dutch ‘dogger-boats which were of the burden of 60 t, which fished only with hook and line for cod and ling’. Within eight to ten days after the dogger-
boats went to sea they came into the sound again ‘so full laden as they could swim.’ Unfortunately, the number of ships in this report does not seem very accurate, the total number of busses that left the Netherlands did not exceed 1000 (Van Bochove, 2004; Poulsen, 2008). This cod fishery was quite persistent, at the start of the 17th century hundreds of doggers still accompanied the fleet of Dutch herring busses in Shetland and, later in the season, further south along the British North Sea coast (Sibbald, 1711).

Archaeological studies on fish bones may also benefit from another piece of information provided by Coenen. The assumption that salted or dried cods were always decapitated (Barrett et al., 2011) is not universally true. According to Coenen Cologne obliged salted cod to be decapitated but the same product was sent to other places with their head on. It would be worthwhile to search the archives of Cologne in order to find confirmation for Coenen’s claim.

4.5 Fishing boats and gear

The number of boats in the fishing villages along the 117 km long coast of Holland at the start of the 16th century can be derived from inventories by the States of Holland and Vrieslant (Anonymous, 1494, 1514). The villages owned about 140 pinken, 40 small herring boats and an unspecified amount of smaller boats. Some buysen were counted as well, most lying in the Oude Rijn in Katwijk aan Zee. The flat-bottomed pink remained very popular to fish for flatfish and gadids along the coast until the 19th century. A detailed building plan is provided by Witsen (1671).

Fishermen along the Dutch coast used various types of fishing gear made of hemp. Plaice, sole, salmon and cod nets operated from pinken were specialised simple trawls. It is not clear if the flounder nets that were used in the southern estuary were different from plaice nets. Cod nets were used to catch porpoises as well.

Fixed gill nets were not named in the Fish Book but there is an indication of their use. An ordinance by the municipality of The Hague regulating fishery activities in Scheveningen (Anonymous, 1540), mentioned ‘nets standing in the sea’.

In the Zuiderzee, fishermen from Holland used waterschepen, boats with a water compartment to hold fish. They fished for flatfish using cuylén, dragnets hung on beams at both sides of the ship. There were many disputes with other Zuiderzee fishermen about the mesh widths of their nets. In a petition these competitors claimed the number of waterschepen from Holland in the Zuiderzee had increased to 600 (Beaujon, 1884, 1885; Molhuijzen, 1844).

While there is much information about herring nets used in the North Sea (e.g. Poulson, 2008) the composition of drift nets (Ervynck et al., 2004) used to catch herring along the coast is not clear. Finally, we may add hook and line to catch gadids, and dragnets and seines that were operated from the beach, to the gear used by fishermen along the sandy coast.
Information about the mesh widths of the popular plaice- and sole nets used along the North Sea coast is available from other sources. Two ordinances by the States of Holland (1676 and 1677) tell that plaice nets had a mesh width of ‘twenty-eight’ and the sole nets of thirty-two’. According to Beaujon in the Dutch version of his book (1885) these measures could mean 1/28 Dutch ell or 24.8 mm for the plaice nets and 1/32 ell or 21.7 mm for the sole nets.

Disputes about mesh widths of dragnets used to catch flatfish (plaice, flounder and turbot) in the Zuiderzee were older. In 1547 Emperor Charles V forbade mesh widths less than ‘5 fishermen thumbs’ (about 12.5 cm). After protest from fishermen from Holland, in 1555 the minimum width changed to 2 thumbs (about 5 cm) (Beaujon 1884, 1885).

The use of beam trawl gear seems to have commenced relatively late in this area. In the United Kingdom acts were passed in Parliament to ban the use of trawls in 1350 and 1371 already (De Groot, 1984), in Flanders trawls were banned in 1499 and in France in 1584 (Roberts, 2007). In 1583 the States of Holland forbade trawling with coor den in the Maas estuary and determined a minimum mesh width. The coor den was described as a net held open by beams of about 3 fathoms width and loaded with up to 16-17 pounds of lead to which stones were added. The first decrees for the coast of Holland, forbidding the use of schrobben ten and declaring the mesh width of sole nets as a minimum were issued in 1676 and 1677, almost a century after Coenen wrote his Fish Book (Cau et al., 1796).

The relatively large buysen, used to catch herring in the North Sea laid in deeper water in the Maas and Scheldt estuary. Coenen mentions that before the French war (1540’s) 200 buysen left from the Maas and numerous others from Zeeland. Recent estimates about the situation in 1600 suggest that about 400 buysen departed from the Maas and about the same amount from the Zuiderzee. Detailed information on their numbers from the 17th till the 19th century are provided by Van Bockhove (2004) and Poulson (2008).

Coenen accurately depicted the nets used in passive herring fishery on the North Sea (Fig. 2). Herein caskets also held up a vertical line to which in this case the hemp nets were attached. The whole construction could be 1350 to 1500 m long (Van Vliet, 1994; Poulson 2008). As Coenen also depicted, flags on the surface showed the position of the nets.

The dogger, used to catch gadids in open sea is a less well known boat type. Coenen described doggers as large ships that left the Maas river to catch gadids in North Scotland. After 1655 these boats were used to catch gadids near Iceland and later they were replaced by hoekers (Kranenburg, 1946). The construction of doggers or dog-boats, which were used in England, French, Belgium and Denmark al well, is unknown. The term dogger does not seem to specify a fixed vessel type (McMillan and Parry, 2001).

Coenen’s drawing suggest that gadids along the coast were caught with lines which had sidelines with one hook at the end (Fig. 3). Coenen provides no pictures of gadid fishing in Scotland. Elaborate constructions were used in the beug fishery, but it is not clear from literature when this type of fishery
started. A beug was kept afloat by caskets that held up an underline which in turn held up about 200 fishing lines with 20 hooks (van Vliet, 1994).

4.6 Trade

The availability of Dutch fresh water fish may explain why so many marine and fresh water fish were exported to Belgium and Germany. Export to the populated cities in Flanders fits the demographic imperative, increasing demand for fish in towns stimulated fishing at sea (Barret et al., 2011). The ultimate factor that caused the demand for salted or dried fish in Germany is less clear. Coenen refers to an increased consumption during Lent, witnessing the role of Christianity, but the export was also high during the rest of the year. Population growth in cities will have contributed to the demand but also the decline of local fish populations, caused by the erosive effects of deforestation (Tittizer and Krebs, 1996) has to be taken into account. Coenen mentioned that dried skate was exported to German 'labourers in vineyards and mountains', suggesting a demand for fish from ecological disrupted areas.

Except for herring, the fish trade took place in a free market in which small opportunity seekers like Coenen as well as wholesalers operated. The only restrictions seem to have been made by the market places; they could refuse certain species or enforce preferred conservation methods. Fresh fish was popular and could be sold on markets in cities that lay at an acceptable distance from the sea by waterways and roads. The distance between the coast of Holland and the Flemish markets was about 140 km by boat. Assuming a two days voyage, it will have demanded for cold weather conditions to keep the fish fresh. This matches the fact that three of the four species that were send to Flanders (cod, halibut and turbot) were caught by cod fishers during the coldest months of the year. The fourth species, the anadromous sturgeon, could also be caught at sea during the coldest months. Dried and salted fish could be exported to staple markets along the rivers. Detailed information on trade routes may be obtained from the supplemental online table on fish.

During Coenen’s life, fisheries and fish trade were little affected by the start of the Dutch uproar against the Spanish Empire (1568-1648). But even so Coenen noticed the decline of the market in Antwerp already, as wholesales started to circumvent it by trading plaice directly with the fishing villages. Some years after the Fish Book was completed in 1584, Antwerp became isolated as result of the occupation by the Spanish empire. Up until the Twelve Years' Truce (1609-1621) the Flemish cities could hardly be reached by Dutch traders (De Vries and van der Woude, 1995). It is believed that in the long run, these political troubles caused the decline of fisheries in the southern provinces of the Netherlands and Flanders (Ervynck et al., 2004; Kranenburg, 1946; Tys and Pieters, 2009).

One might expect that fishing villages along the coast would benefit from the fact that the cities in Holland became the new wealthy urban centres. But the geographical location of these fishing villages also had a disadvantage, as the fishing horizon for herring and gadids moved on they could not participate with their own boats. The lack of deep water harbours confined them to use relatively small
flat bottom boats. In the case of herring, six harbour towns monopolised the catch and trade while fishermen became mere employees.

The classification of 16th-century consumers of marine food may contribute to the interpretation of archaeological sites. Archaeologists use food scraps like fish bones to derive the social class of the inhabitants at a site. Better knowledge of consumer preferences increases the distinguishing power of this method. The conclusion from historic sources and ancient paintings that the rich preferred fresh, rare and large fish (Hoffman, 2005; Van Dam, 2009) is confirmed by Coenen. The distinction between fish for the rich and for the poor is usual in archaeology. Coenen, however, shows us that in his day the division of consumers was much more refined.

Acknowledgements

Many thanks to Niels Daan for his valuable comments which helped us much to improve our paper. The authors also want to thank Godfried van Moorsel for his comments on an earlier version of the manuscripts and Jan Sander and Piet Spaans for providing additional 16th century sources on boats and nets and Peter Reijnders and Wim Wolff for comments on the marine mammals. Finally, the useful comments of two reviewers is greatly appreciated.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at http://dx.doi.org/10.1016/j.fishres.2014.09.001.

(Bennema_Rijnsdorp_2015_Supplementary_data.html)
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