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Government mandate on the collection and recycling of fishing gear and recreational boats

Interim report on recreational boats

The Swedish Agency for Marine and Water Management (SwAM) was mandated to facilitate the collection and recycling of recreational boats, and to survey the extent of the problem of abandoned boats from a lifecycle perspective. The mandate also includes proposing measures to recycle more boats. The mandate was received in the letter of appropriation for 2022.

To facilitate the collection and recycling of derelict and abandoned recreational boats and reduce their environmental impact, SwAM has proposed several measures.

These proposals include a long-term recycling system and clearer responsibility and authority for municipalities to dispose of derelict and abandoned recreational boats. Currently, no authority is explicitly responsible for the management of derelict and abandoned recreational boats.

Furthermore, SwAM proposes the introduction of a national register of recreational boats.

Although a Swedish register has existed before, in the light of new knowledge on the environmental impact of recreational boats and increasing plastic waste, SwAM recognizes the environmental benefits of reintroducing such a register.

Finally, proposed measures include that an Extended Producer Responsibility scheme is investigated further, that knowledge about environmental risks increases as well as the cooperation between relevant stakeholders.

The Swedish Agency for Marine and Water Management hereby delivers this interim report on the mandate to the Government Offices with the following attachments:

1. Recreational boats in a circular economy: mapping and proposed measures (Virgin, et al., 2023)
2. Derelict recreational boats, fishing gear and aquaculture. Judicial inquiry (Laas, 2023a)
3. Derelict recreational boats, responsibility. In-depth judicial inquiry (Laas, 2023b)

Decisions on this matter have been made by Deputy Director-General Eva-Britt Eklöf Petrusson following a report by analyst Josephine Rubia. In the final handling, Head of Department Mats Svensson, Heads of Sections Monica Forsell, Inger Dahlgren and Karin Wall, Deputy head of Section Fredrik Lindgren and Legal Advisor Fredrik T Lindgren have all contributed.

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Abbreviations

APER: Association pour la Plaisance Eco-Responsable. National French boating association for environmental responsibility

EBI: European Boating Industry

EPR: Extended Producer Responsibility

GFRP: Glass Fibre Reinforced Polymer. Plastics reinforced with fibre glass, common in hulls of recreational boats and in wind turbine rotors.

HELCOM: Helsinki Convention. An agreement among the countries around the Baltic Sea to protect its environment.

ICOMIA: International Council of Marine Industry Associations

IMO: International Maritime Organization

OSPAR: Oslo-Paris Convention. A unification of two previous conventions (the Oslo Convention and the Paris Convention)

PAH: Polycyclic aromatic hydrocarbon. A group of substances formed in incomplete combustion, which can be hazardous to human health.

TBT: Tributyltin. A prohibited substance which was previously used in anti-fouling paint to prevent biofouling.

UNEA: United Nations Environment Assembly

Swedish laws

English	Swedish
Act on Certain Provisions Regarding Finds at Sea (Sea Finds Act)	<i>Lag (1918:163) om vissa bestämmelser om sjöfynd</i>
Act on Finds	<i>Lag (1938:121) om hittegoods</i>
Act on Recreational Boat Register	<i>Lag (1987:773) om fritidsbåtsregister</i>
Act with Particular Provisions on Street Maintenance and Signs	<i>Lag (1998:814) med särskilda bestämmelser om gaturenhållning och skyltning</i>
Act on Moving Vehicles in Certain Cases	<i>Lag (1982:129) om flyttning av fordon i visa fall</i>
Marine Environmental Regulation	<i>Havsmiljöförordning (2010:1341)</i>

Summary

This is an interim report on the government mandate assigned to the Swedish Agency for Marine and Water Management (SwAM) on 22 December 2021 regarding the collection and recycling of fishing gear and recreational boats. The report only contains the part of the government mandate that relates to the collection and recycling of recreational boats. The interim report was sent to the Government Offices (Ministry of Climate and Enterprise) on 1 September 2023.

SwAM has conducted a survey of the extent of the problem of derelict and abandoned recreational boats from a lifecycle perspective, as well as a judicial enquiry to identify legal obstacles to collection and recycling. In the survey, it has been estimated that there could be up to 400,000 recreational boats in Sweden that are derelict and in need of collection for recycling or reuse (Virgin, et al., 2023). At present, about 500 boats are recycled each year. The fact that only a low number of boats are addressed and that end-of-life boats are increasing means that the need for more extensive management must be considered. The judicial enquiry identified a lack of opportunities for government agencies and municipalities to deal with derelict and abandoned recreational boats in a satisfactory manner. No single actor is responsible for managing recreational boats of unknown ownership (Laas, 2023a; Laas, 2023b). Proposed measures are based on what has been presented in background reports, previous government reports, research, and in dialogue with other government agencies and stakeholders.

In this interim report, SwAM has found that the extent of the problem of derelict and abandoned recreational boats demands several types of actions. Measures are therefore proposed to strengthen the opportunities for government agencies, municipalities and other relevant stakeholders to address derelict and abandoned recreational boats – see Figure 1.

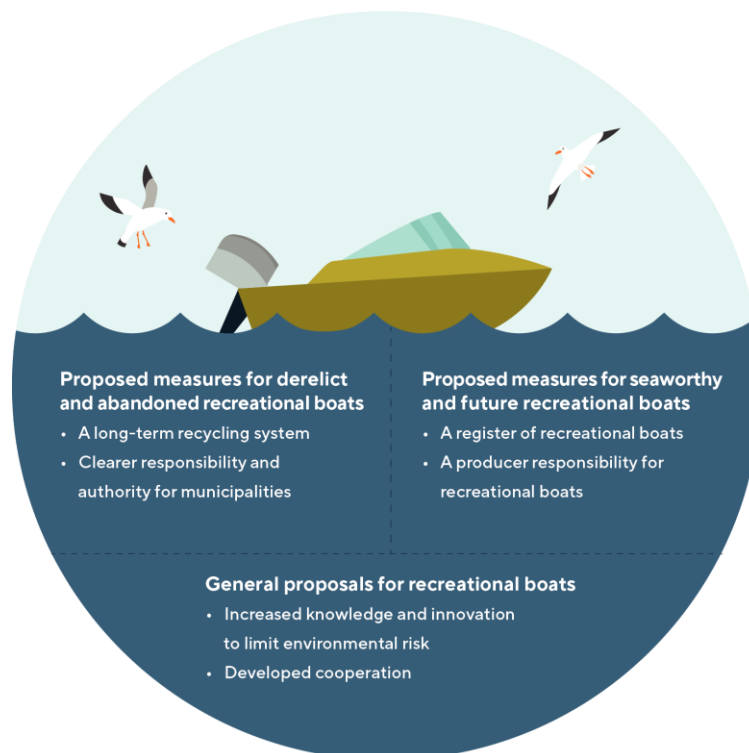


Figure 1. The proposed measures of SwAM include managing derelict and abandoned recreational boats, seaworthy and future recreational boats, as well as promoting knowledge to limit environmental hazards and enhance cooperation between stakeholders in connection with recreational boats.

1 The government mandate and its preparation

In the 2022 letter of appropriation, the Swedish Agency for Marine and Water Management was given the following mandate:

Collection and recycling of fishing gear and recreational boats

The Swedish Agency for Marine and Water Management shall conduct cleaning efforts to collect historically derelict and lost fishing gear and recycle them in line with the transition to a circular and non-toxic economy. With the support of investigations, SwAM shall enable effective and prioritised cleaning efforts. SwAM shall also facilitate the collection and recycling of recreational boats and provide information to prevent the loss of fishing gear. SwAM shall survey the extent of the abandoned recreational boats problem from a lifecycle perspective and propose measures to increase boat recycling. This part of the mandate will be reported to the Government Offices (Ministry of the Environment) by 1 September 2023. SwAM shall account for an annual result of the mandate in its annual reports for 2022 and 2023, and shall submit a final account of the result of the mandate to the Government Offices (Ministry of the Environment) by 1 February 2025. (Regeringskansliet, 2022)

This report presents the results of SwAM's survey on abandoned recreational boats, addressing the lifecycle perspective, legal obstacles, and proposed measures to enhance boat recycling.

1.1 Description of the mandate

This interim report is based primarily on three reports produced by order of SwAM.¹ The first report contains a methodology to estimate the number of abandoned recreational boats, their environmental impact from a lifecycle perspective, and measures to recycle more recreational boats (hereinafter referred to as 'the survey' or Virgin et al., 2023). The second and third reports have been produced by the Swedish Institute for the Marine Environment (*Havsmiljöinstitutet*) by order of SwAM, and investigate 1. legal obstacles to efficient collection and recycling of fishing gear and recreational boats (hereinafter referred to as 'the judicial enquiry' or Laas 2023b). The deeper judicial enquiry contains proposed measures to facilitate dealing with both previously abandoned and future abandoned recreational boats. See the further discussion on the implementation of the government mandate in section 3.

1.2 Delimitations

This report is delimited to issues regarding recreational boats. Issues relating to fishing gear are not part of this interim report, and will be accounted for in the final account of the government mandate on 1 February at the latest.

The task of the government mandate is to propose measures to recycle more recreational boats. It is not part of the mandate to present legal amendments, and consequently no legal amendments are presented. Nor is it part of the mandate to analyse the consequences of the proposed measures.

The government mandate deals solely with recreational boats, and other boats are not included. Another delimitation is the focus on recreational boats in Sweden.

¹Appendix 1. *Recreational boats in a circular economy: Survey and proposed measures* (Virgin, et al., 2023).

Appendix 2. *Derelict recreational boats, fishing gear and aquaculture. Judicial inquiry* (Laas, 2023a).

Appendix 3. *Derelict recreational boats, distribution of responsibility. In-depth judicial inquiry* (Laas, 2023b).

1.3 Definitions

1.3.1 *Recreational boat*

A recreational boat is defined based on Directive 2013/53/EU of the European Parliament and of the Council of 20 November 2013 on recreational craft and personal watercraft (hereinafter referred to as 'the Recreational Craft Directive'). The definition includes all types of watercraft with a hull length from 2.5 m to 24 m, regardless of the means of propulsion.

1.3.2 *Seaworthy recreational boat*

A seaworthy recreational boat follows the definition of a recreational boat, and is actively used or possible to use actively after simple measures.

1.3.3 *Derelict recreational boat*

A derelict recreational boat follows the definition of a recreational boat, and includes boats in poor condition with a known owner. 'Poor condition' implies that the boat has little or no economic value or value in use. From a lifecycle perspective, a derelict recreational boat has left the phase of use but has not yet been addressed as waste. A derelict recreational boat can be found on land or in the water.

1.3.4 *Abandoned recreational boat*

An abandoned recreational boat follows the definition of a recreational boat, where the owner is unknown. In the report on the government mandate, the definition follows the judiciary enquiry. The condition of an abandoned recreational boat can vary, and functional boats are included (Laas, 2023a). An abandoned recreational boat can be found on land or in the water.

1.3.5 *Wreck of a recreational boat*

A wreck of a recreational boat follows the definition of a recreational boat, that has been wrecked. Thus, it includes recreational boats that have sunk, run aground, been stranded or been deliberately sunk. The definition is based on the definition of shipwrecks used by SwAM.²

² This definition is different from earlier work by the Swedish Environmental Protection Agency. Wrecks of recreational boats are defined as "boats which, with regard to their condition, the time during which they have been in the same spot or other circumstances, must be considered abandoned and apparently have little or no value" (Naturvårdsverket, 2011, s. 61). The definition from the Swedish Environmental Protection Agency corresponds to derelict or abandoned boats, as used in the present report (as defined above).

2 Background

2.1 The role of the Swedish Agency for Marine and Water Management

SwAM strives to prevent and reduce the occurrence of marine litter. The role of SwAM is to act as a driving, supporting and unifying force in the work of dealing with marine litter, nationally and internationally, within the conventions of OSPAR and HELCOM.

Dealing with marine litter has attracted attention globally, especially in relation to issues of plastics and a non-toxic environment. In March 2022, 175 countries within the UN Environment Assembly (UNEA) agreed that a global legally binding agreement to stop plastic pollution was needed, and a resolution to begin negotiations was adopted. The second negotiation meeting was held in June 2023. Of the plastic used, about eight million metric tonnes of plastic waste end up in our oceans, and this pollution is expected to increase unless effective measures are taken (World Economic Forum, 2016). SwAM supports the Swedish Government in negotiations alongside the Swedish Environmental Protection Agency and the Swedish Chemicals Agency. Negotiations take place twice a year, aiming to reach an agreement to be approved by the UN at a diplomatic conference.

The Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment was issued in 2019. Estimates of the number of items of litter on beaches have concluded that 80–85 percent of marine litter in the EU consists of plastic. Of this plastic litter, 50 percent consists of single use plastic products and 27 percent consists of fishing-related items. To reduce the marine litter from fishing-related items, SwAM proposed a bill aiming to incorporate the demands of the directive through an EPR for fishing gear containing plastic (2020).

According to paragraph 8 of the Marine Environmental Regulation (2010:1341), SwAM is responsible authority for the marine environmental management. The regulation concerns the management of the quality of the marine environment (paragraph 1). The regulation implements Directive 2008/56/EC *on establishing a framework for community actions in the field of marine environmental policy* into Swedish legislation, and aims to achieve or maintain good environmental status in the marine environment. According to paragraph 24 of the Marine Environmental Regulation (2010:1341), SwAM shall propose Programmes of Measures for the marine environment to be established under paragraph 28 of the regulation. Programmes shall contain measures necessary to reach the environmental quality standards in SwAM's regulation (HVMFS 2012:18) on what constitutes good environmental status and environmental quality standards with indicators for the North Sea and the Baltic Sea. Measures on marine litter in the Programme of Measures established in 2021 include:

Measure 19: To promote efficient and sustainable collection and reception of lost fishing gear and the prevention of future losses of fishing gear.

Measure 20: To produce, in cooperation with the Swedish Environmental Protection Agency, a national information campaign targeted at the public and consumers on common types of litter in the marine environment, how they affect the environment and the link to consumer behaviour.

Measure 21: To support initiatives which promote, organise and conduct beach cleaning in particularly affected areas.

Measure 22: To conduct strategic work through the inclusion of marine litter in relevant waste management plans and programmes, including municipal waste plans, highlighting the significance of waste management in the generation of marine litter. Priority needs to be given to plastic material streams, and instruments need to be investigated in order to reduce the occurrence of plastic objects as litter in the marine environment.

Measure 23: When revising municipal waste plans, identify and highlight how waste management can help reduce the occurrence of marine litter and set targets for such work.

Measure 42: Product, material and marking developments regarding fishing gear.

The work to prevent and reduce the occurrence of marine litter, including measures, contributes to achieving the Swedish environmental targets *Living lakes and watercourses*, *Marine environment in balance and a living coast and archipelagos*, as well as global Sustainable Development Goal 14, target 1 *Reduce marine pollution*.³

2.2 International proposals for measures to deal with recreational boats

Considering end-of-life and abandoned recreational boats as marine litter is not widely acknowledged. Current environmental legislation is not adapted to boats as marine litter. Recreational boats are not mentioned in the Marine Strategy Framework Directive (2008/56/EC) or as waste according to Directive 2008/98/EC on waste and repealing certain Directives.

Including recreational boats in the definition of marine litter has been brought to the fore in several recent reports. In 2019, the International Maritime Organization (IMO) published a report with guidance on waste management and management of recreational boats, since recycling end-of-life recreational boats is complicated (IMO, 2019). The lifecycle of recreational boats is partially included in OSPAR and HELCOM. The issue of environmental impact from recreational boats and the responsibility to address the impacts concern several stakeholders in society, and pose a growing challenge.

The European Boating Industry (EBI) has published *A roadmap on the implementation of the circular economy for end-of-life recreational boats*. This report formulates targets for dealing with derelict recreational boats, proposing an EPR scheme by 2030:

“A key element is the implementation of a financing system to allow setting up a permanent structure and fund to collect, treat and dismantle end-of-life boats. It should be considered that the last owner of a boat usually cannot afford the high costs of proper disposal and affordable solutions are therefore needed to incentivise proper dismantling. [...] Extended Producer Responsibility scheme with an eco-contribution from companies placing the boat on the market and subsidies from existing sector-specific registration fees or taxes (such as France, APER)” (EBI, 2023, s. 8).

Another proposed measure to deal with end-of-life recreational boats is to introduce a product pass for recreational boats. In a German report from 2023 (Burgstaller, et al.) a digital concept is proposed, according to which a modular product pass with targeted information from stakeholders promotes a circular economy. The report was produced following a mandate from the German Environmental Agency. One of the proposed measures in the report is that the product pass should be included in the EU Directive on recreational craft (2013/53/EU). Further, European

³ To prevent and significantly reduce all types of marine pollution by 2025, especially from land-based sources, including marine litter and release of nutrients.

level waste codes for end-of-life products are proposed to be included in the European list of wastes according to the Commission (EC) decision 2001/118/EC on amending Decision 2000/532/EC regarding the list of wastes.

See section 3.1.3 for a mapping of measures to manage end-of-life boats in other countries.

2.3 Number of recreational boats

The number of recreational boats in Sweden cannot be given with absolute certainty, since there is no complete registration. The best previous estimate available is the Boat Life survey carried out by the Transport Agency on Swedish recreational boats and their use (Transportstyrelsen, 2021). The survey is conducted every five years. In the 2020 Boat Life survey (partly financed by SwAM), the Transport Agency estimated that there were 948,900 recreational boats in Sweden, of which 864,200 were estimated to be seaworthy (Transportstyrelsen, 2021). According to these estimates, at least 84,700 recreational boats are in need of repair or were wrecks of recreational boats.

The survey conducted within this government mandate issued to SwAM has made separate calculations, and has estimated a higher number of derelict and abandoned recreational boats. As shown in Figure 2, the period 1965–1980 had high levels of production and sales of recreational boats. The National Maritime Museum highlights the plastic revolution of the 1960s as a milestone for recreational boats in Sweden (Sjöhistoriska Museet, 2022).

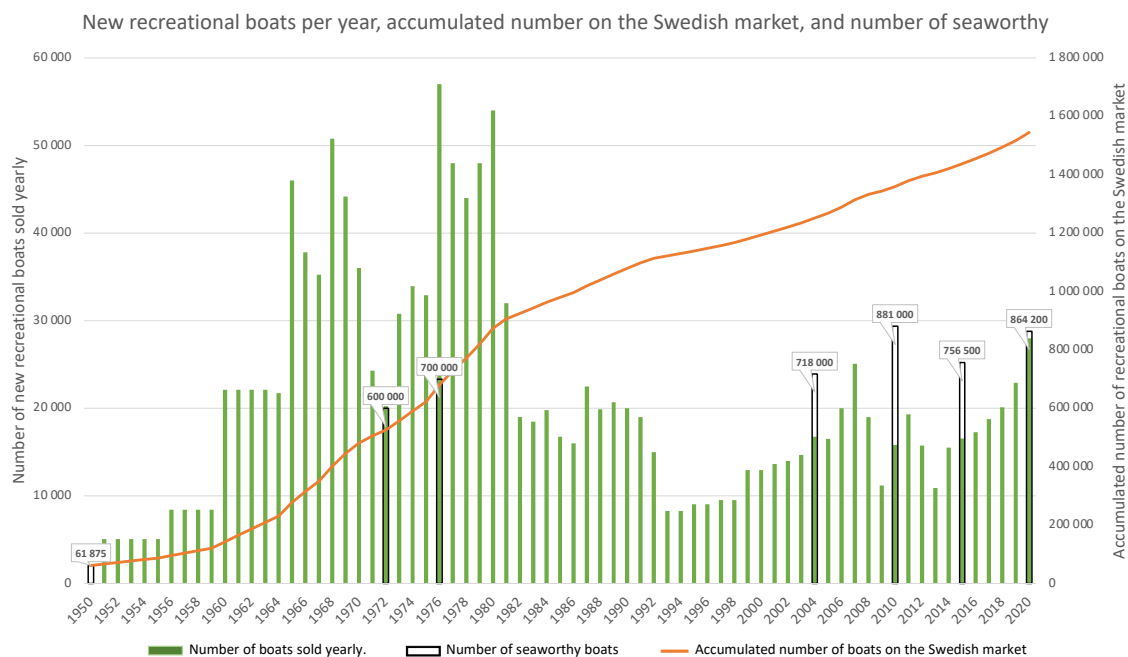


Figure 2. The number of recreational boats sold yearly in Sweden, the number of seaworthy recreational boats, and the accumulated number of sold boats. The stock size is based on data from Boat Life SOU 1974:95 for the years 1950–1974 and the Boat Life Survey of the Transport Agency for data on seaworthy boats 2004–2020. The number of sold boats is based on data from SOU 1974:95 for 1950–1971 and from Sweboat (2020) and Hansell (2019) for data between 1972 and 2020 (Virgin, et al., 2023).

Between 1950 and 2020, more than one and a half million recreational boats were sold in Sweden. Of those, just over 724,000 recreational boats are no longer seaworthy.⁴ With regard to approximately 25,000 boats having been addressed during this period, about 700,000 recreational boats remain, of which 1–5 percent are estimated to be abandoned, giving up to 35,000 abandoned recreational boats (Virgin, et al., 2023).

Approximately 300,000 of the remaining recreational boats are estimated to be made of wood (Jordbruksdepartementet, 1974). Given the limited life span of wood, it is reasonable to assume that a large portion of the 300,000 wooden boats have been put to other uses or have already decomposed naturally.

According to the survey, this would mean that up to 400,000 recreational boats in Sweden could be derelict (with up to 35,000 of them abandoned) and in need of recycling. The survey's calculation is in line with the estimates used by the Transport Agency in the Boat Life survey.⁵

2.4 Amounts of plastic waste

The vast majority of the possibly 400,000 derelict recreational boats are expected to be smaller in size and found on land. They are mostly made of glass fibre reinforced polymer (GFRP). See Figure 3 for the development of the distribution of different boat materials in Sweden between 1950 and 2020.

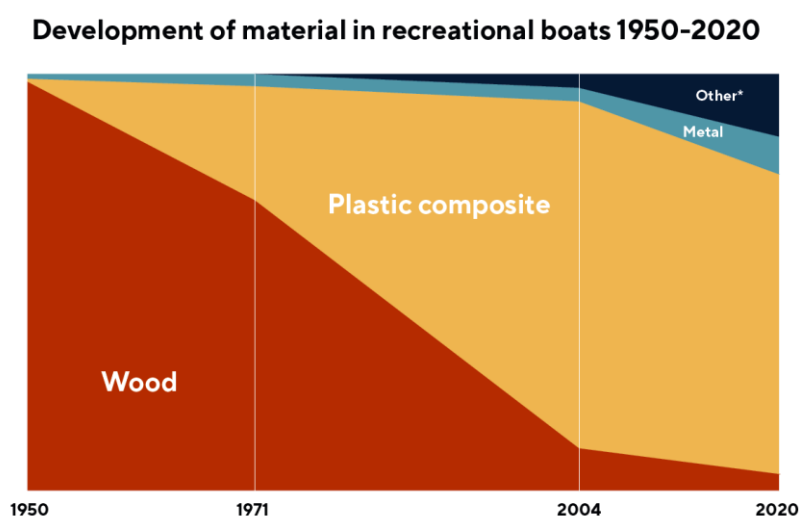


Figure 3. Distribution of recreational boats by type of material over time, 1950–2020. Other (*Övrigt*) mostly consists of rubber (Virgin, et al., 2023).

“Thermosetting plastic composites is one of the more challenging plastic flows to recycle. They consist of a matrix of plastics reinforced with particles or fibres. Fibres such as fibreglass make mechanical recycling hard by clogging filters when the molten plastic is filtered. Thermosetting plastic composite demands alternatives to mechanical recycling, since thermosetting plastics cannot be re-melted into new products. Mechanical milling and pyrolysis are two examples of existing techniques for recycling glass fibre reinforced plastics. None of the techniques are used in Sweden” (Naturvårdsverket, 2021, s. 87).

⁴ The estimate is based on the accumulation of new recreational boats in the Swedish market and the growth in the stock of seaworthy recreational boats.

⁵ The survey's calculation should be regarded as an estimate based on a new method of calculation. It therefore needs to be confirmed through repeated calculations using the method before being seen as fully reliable. This does not mean, however, that it wholly lacks reliability or relevance for the purpose of the government mandate.

Thermosetting plastic composites constitute a large waste flow, in which the need for waste management is expected to grow. About 1–2 percent of all seaworthy recreational boats are estimated to reach end-of-life each year (EU, 2017; EBI, 2023; Virgin, et al., 2023).

In Sweden, with 864,200 seaworthy recreational boats according to the latest Boat Life survey, that means an increase of 9,000–17,000 end-of-life boats each year. According to studies from the French industry organisation for producers of recreational boats, the average volume of composite waste per disassembled recreational boat is about 0.77 metric tonnes (APER, 2023). That would mean an annual increase of 7,000–13,000 metric tonnes of composite waste from recreational boats in Sweden each year.

The exact size of the waste flow for thermosetting plastic composites and its recycling needs to be investigated further. For a further discussion of waste management, see section 5.3.1.3.

2.5 Environmental impact of derelict and abandoned recreational boats

Derelict and abandoned recreational boats contribute to littering, and are a source of pollution. They can pose a direct hazard to other boats, people and animal life. The results of the survey show that more knowledge about the environmental impacts of abandoned recreational boats is needed (Virgin, et al., 2023). The possible negative impact of recreational boats is presented below.

Microplastics: Three quarters of recreational boats are made of plastics (Transportstyrelsen, 2021). Besides littering, abandoned recreational boats can contribute to the issue of microplastics. A large proportion of marine microplastics stems from larger plastic items pulverised into micro sizes during their process of decomposing. Microplastics can adsorb toxins in the aquatic environment, and may be mistakenly eaten by marine organisms, which thereby consume the toxins (Transportstyrelsen, 2021).

Fibreglass: The plastic used in recreational boats is glass fibre reinforced polymer (Naturvårdsverket, 2022). The effect of fibreglass on marine life is not known, but studies have shown accumulation in invertebrates (Turner & Rees, 2016).

Hazardous substances: Abandoned recreational boats often contain hazardous substances in anti-fouling paints used to protect the hull. These substances may contain organotin compounds such as TBT. Copper and zinc are common components of anti-fouling paints to protect hulls from the growth of subaquatic organisms. Lead can be found in the keels of sailing boats in particular.⁶ These heavy metals are toxic to aquatic life, and may contaminate sediment or water and accumulate in micro algae, invertebrates and birds. Moreover, recreational boats can contain chemicals such as flame retardants in electronic equipment, textiles or plastics. Heavy metals may also be found in batteries left on board, and oil products in bunker tanks or machine rooms.

Impact on benthic life: An abandoned and sunken recreational boat affects the sea floor physically through suffocation and light depletion.

⁶ Lead is also present in many older recreational boats made of wood, painted with red lead to protect the hull from decomposing micro-organisms or with lead paints to achieve desired hull colours.

Asbestos: Older recreational boats may contain asbestos. The impact of asbestos on marine life is not fully known, but it has been shown to accumulate in invertebrates (Turner & Rees, 2016).

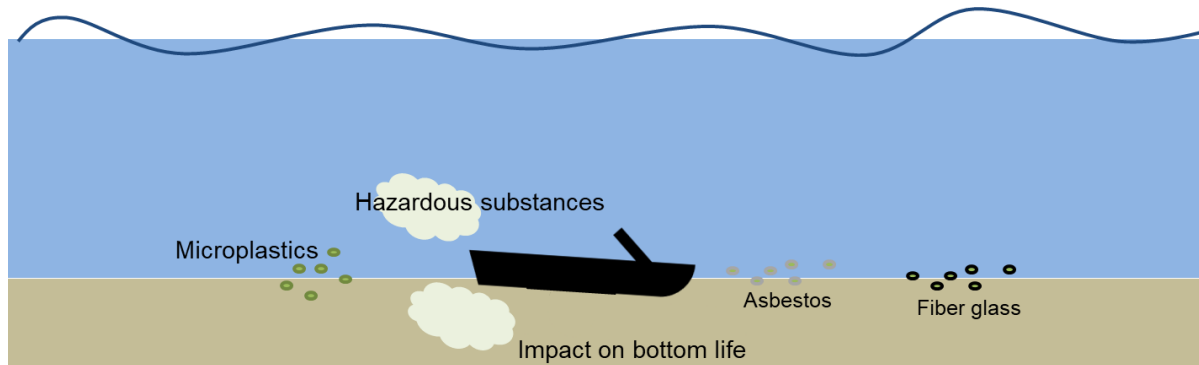


Figure 4. Illustration of the impact and pollution connected to abandoned boats, based on Turner & Rees (2016) (Virgin, et al., 2023).

In measures taken within national environmental monitoring of TBT in the marine environment, threshold levels for good environmental status are exceeded in many Swedish waters, regarding both sediment content and coastal effects of TBT-contaminated sediments (Havs- och vattenmyndigheten, 2021). The TBT content shows that it still has a negative impact on the marine environment. TBT has been described as one of the most toxic substances ever released into water by humans. Despite having been forbidden in anti-fouling paints since 1989, TBT is still frequently detected on hulls and continues to be spread into the aquatic environment.

TBT is one of the substances that contributes the most to good chemical status of water bodies not being achieved in Sweden,⁷ and boat hulls are reportedly a source (Lagerström & Ytreberg, 2018). Older boats pose a bigger environmental threat, since they are more likely to have been painted with anti-fouling paint containing TBT.

“The fact that almost all abandoned boats were produced before 1990 increases the risk of them having been painted with paint containing TBT at some point” (Virgin, et al., 2023).

Recreational boats and constructions related to recreational boats, such as marinas, have been identified as sources of spreading TBT to the marine environment. Still, approved anti-fouling paints contain substances (for example copper) which are judged to have a negative impact on the marine environment, especially in sensitive areas such as shallow coastal ecosystems (Moksnes, et al., 2019).

In previous government mandates and reports conducted by SwAM, it has been suggested that specific measures to manage abandoned recreational boats on land and in water are needed to prevent the indirect spread of TBT to the marine environment. This material is an important foundation for the environmental work already performed by SwAM. By dealing with abandoned

⁷ Many water bodies in Sweden do not meet the goals of good chemical status, good ecological status or good environmental status according to the EU's Water Framework and Marine Strategy Framework Directives. In 2020, the Transport Agency and SwAM reported a government mandate on discharges of washwater from scrubbers on ships (Havs- och vattenmyndigheten; Transportstyrelsen, 2020). The results of the government mandate showed that good chemical status is not reached in 108 out of 110 coastal water bodies in the Västerhavet water district, in 45 out of 178 in the Södra Östersjön water district, and in 21 out of 85 in the Bottenhavet water district. The fact that good chemical status is not achieved in these areas was said to be mainly due to exceeding limit values for cadmium, lead, TBT and polycyclic aromatic hydrocarbons (PAH). When good ecological status is not achieved in coastal water bodies, this is mainly due to exceeding the limit values for the specific pollutants copper, zinc and arsenic (Havs- och vattenmyndigheten; Transportstyrelsen, 2020).

recreational boats, emissions of other hazardous substances in anti-fouling such as copper and zinc may also be reduced (Havs- och vattenmyndigheten, 2021).

By managing derelict and abandoned recreational boats, the addition and concentration of hazardous substances in the marine environment can be reduced, thereby enhancing the possibility of achieving good chemical and ecological status.

2.6 Efforts to manage and recycle recreational boats

In Sweden, there are only a few actors that officially deal with recreational boats for recycling and reuse. Recreational boats are not considered household waste, but certain recycling centres receive smaller recreational boats (Naturvårdsverket, 2011). In the survey (Virgin, et al., 2023), examples include 15 recycling centres which receive recreational boats to some extent. In most cases, only a few boats are received yearly.

Between 2018 and 2023, SwAM financed a campaign to encourage more boat owners and municipalities to scrap derelict recreational boats. The Båttretur⁸ network procured by SwAM has a nationwide system for receiving end-of-life boats. The network has drawn up a process whereby boat owners or municipalities can report a boat for dismantling on their website.⁹ After being received and weighed at one of the facilities, the boat is put through a hammer mill to be shredded. Iron, copper and aluminium are then sorted for metal recycling. Next, an organic fraction sorts fibreglass reinforced plastics to prepare for energy recycling. Larger metal parts are recycled (smeltery), and the plastics are taken for energy recovery at waste incineration facilities. In terms of weight fractions, 25 percent is recycled as material and 75 percent is recycled as energy.

Apart from the complexity of sorting and recycling plastic material from recreational boats, it is a challenge to find buyers for the recycled material, especially considering the risk of hazardous substances such as TBT and heavy metals like copper, zinc and lead stemming from anti-fouling paint (Naturvårdsverket, 2021).

At Båttretur, keels can be sorted from organic fractions, consisting mostly of GFRP where most of the anti-fouling paint is found. When burnt at 850°C, organometallic compounds are broken down into carbon dioxide, water and oxidised metal. As the pH level of the ash is high, the metals are mainly bound as hard to leach metal hydroxides. If there is TBT on a boat made of iron or aluminium and it does not come off during fragmentation, a similar oxidation process takes place and tin is bound to the slag. Anti-fouling paint that comes off the hull during fragmentation is gathered in a fraction <5 mm, which is deposited at an approved depot.

Some reuse of components from received recreational boats takes place at the recycling facilities.¹⁰ The number of recreational boats received and dismantled via the dismantling campaign is reported in Table 1.

⁸ Båtskroten, Stena Recycling and Sweboat are the actors behind the network.

⁹ Before a recreational boat is sent to one of the facilities, the owner must certify that it has been decontaminated and does not contain hazardous waste such as fuel, oil, fuel filters, oil filters, LPG cylinders, fire extinguishers, glycol, batteries, distress rockets, red lead, asbestos or other flammable substances, and that the septic tank has been emptied.

¹⁰ Båttretur has a record of interest where boat owners can describe which components they want. Thus, when a boat is received, components can be reused for other boats and the owner of the dismantled boat can get paid for reused components. There is no detailed report on which parts have been reused. It is therefore not possible to report the extent of reuse.

Table 1. Number of dismantled recreational boats per year at Båttretur, financed by the Swedish Agency for Marine and Water Management.

Year	Funding from SwAM	Number of dismantled boats
2018	SEK 3 million	416
2019	SEK 5 million	623
2020	SEK 4 million	555
2021	SEK 2 million	253
2022	SEK 4.5 million	545
2023 ¹¹	SEK 2.3 million	223

Despite it being possible to recycle derelict recreational boats, a remaining challenge is that boats are left by their owners on land and in water. This problem is expected to grow in the near future, as only a few owners choose to send their boats for dismantling. The current financing process for managing recreational boats is problematic from several aspects. Only a few boats are dismantled at the initiative of the owner, and the dismantling that takes place is mostly due to temporary government financing by SwAM. Before the government mandate, SwAM identified several possible explanations for the low level of recycling for derelict recreational boats. The identified factors are:

- » The expense of sending for dismantling, at approximately SEK 3,500 per tonne.¹²
- » The varying size of producers, spread across several countries.
- » Legal obstacles to removing derelict boats.
- » Limited opportunities to recycle material.
- » Low insight into and knowledge about the magnitude of the problem.

2.7 Previous investigations into derelict and abandoned recreational boats

Managing derelict recreational boats has been the topic of several reports in recent decades. In the report *Disposal of plastic end-of-life boats*, the issue of dealing with derelict recreational boats is addressed from an environmental perspective (Eklund, 2013). In the same year, the Håll Sverige Rent (Keep Sweden Tidy) foundation presented a number of measures to prevent derelict recreational boats from being abandoned in nature, and to simplify reuse, recycling and dismantling (Håll Sverige Rent, 2013).

Swedish government agencies have addressed problems concerning derelict and abandoned recreational boats on two occasions: *Wrecks and ownerless boats* by the Swedish Agency for Public Management in 2008 and *Littering and derelict recreational boats* published in 2011 by the Swedish Environmental Protection Agency. Further, the issue of end-of-life boats from an

¹¹ The figures for 2023 are valid until 5 July 2023.

¹² For boats not covered by the dismantling subsidies, it costs SEK 3,500 per tonne to scrap the boat (Svenska Båttunionen, 2023). According to the pilot study *Swedish junk boats*, the mean cost of dismantling larger boats (6–10 m) was SEK 35,000 including transport (Håll Sverige Rent, 2013).

environmental perspective has been partially covered in SOU 2020:83 *The Sea and Man*. Watercrafts have also been covered in *Changed rules for jet skis* (SOU 2022:49) by the Swedish Transport Agency. The two latter investigations only cover some of the perspectives discussed in this government mandate.

The investigation of The Swedish Agency for Public Management (2008) concerning wrecks and ownerless boats concluded that the owner has the primary responsibility for their boat and that routines to find owners needed to be strengthened. Further, it was stated that there was a need for clearer societal authority to act and place demands on owners. SwAM was of the opinion that municipalities had the greatest need for increased authority, especially in situations where owners fail to take their responsibility and the municipality needs to have the right to remove boats that constitute litter (2008).

The Environmental Protection Agency's report (2011) was a continuation of the investigation carried out by The Swedish Agency for Public Management, directed at responsibility, tracking owners and authority to manage boats that constitute litter. SwAM proposed several measures to deal with boats that constitute litter and derelict recreational boats, including a national EPR scheme with an ambition to work for an EU-wide EPR. Further, SwAM proposed that Sweden should introduce a register of recreational boats. The Swedish Maritime Administration was responsible for the register, which was regulated in the Act on Recreational Boat Register (1987:773). According to the government bill (prop. 1992/93:102) on abolishing the Act on a Recreational Boat Register, the register was discontinued because the fees did not cover the costs relating to operating the register, among other reasons. Since then, the issue of a register has been discussed several times. The Environmental Protection Agency proposed a register of recreational boats in its report (2011). The Drafting Committee for Environmental Goals (*Miljömålsberedningen*) has also proposed a recreational boat register in its committee report *The sea and the human* (SOU 2020:83). According to the report, a register would be beneficial for the marine environment, referring to *Impacts of recreational boats on shallow coastal ecosystems in Sweden* (Moksnes, et al., 2019). Other reasons given for a register included building knowledge and monitoring the impacts of recreational boats on the environment, as well preventing older recreational boats from being dumped.

It should also be noted that the Transport Agency has been proposed to investigate the prerequisites for a register of jet skis according to the official report *Changed rules for jet skis* (SOU 2022:49).

In 2011, the Environmental Protection Agency further proposed amended rules to give the municipalities better opportunities to manage shipwrecks. SwAM proposed that, similarly to car wrecks, municipalities should be given the right to move and scrap shipwrecks. According to the proposal, the municipalities would become owners of the shipwrecks at the time of moving them. SwAM proposed changes to the Act on Moving Vehicles in Certain Cases and the Ordinance on Moving Vehicles in Certain Cases, to include shipwrecks in addition to land vehicles. In the memorandum, SwAM said:

Shipwrecks should be defined as ships which, with regard to their condition, the time they have been in the same spot or other circumstances, must be regarded as abandoned and which obviously have little or no value. Ownership of shipwrecks which have been moved should immediately transfer to the municipality. The municipality should be given the right to demand payment from the owner to cover costs related to moving, if the owner is known. Similarly, to the rules on car wrecks, it should be a right for municipalities to deal with a shipwreck and not a responsibility (Naturvårdsverket, 2011, s. 61).

From the two mentioned investigations, the then Ministry of the Environment produced a memorandum with a proposal for an Act on Moving Boats in Certain Cases, which was circulated for comments (M2012/1824/R). The Ministry's proposal differed from the Environmental Protection Agency's proposals in some respects. The Ministry judged that the rules on moving boats were not systematically suited within the rules governing traffic. Hence, it proposed a separate law on moving boats (2012), and the term 'scrap boats' (*skrotbåtar*) was used instead of 'shipwrecks'. The proposal also included craft other than scrap boats, representing an expansion compared to the proposal in the Environmental Protection Agency's report. For example, the proposal included boats that could pose a risk to general security by drifting at sea or causing disruption to public order by being moored in forbidden locations. The rules were only to be applied to smaller boats. In the memorandum, it was noted that EPR for derelict boats should be further investigated, but that a register of recreational boats was deemed too costly in comparison to the benefits it would bring, that identity markers could be removed and that a register may infringe upon personal privacy. The memorandum was circulated for comments, but no actions in line with the proposals were taken. Thus, the problems relating to derelict and abandoned recreational boats remain, as has been shown in the judicial inquiries.

3 Implementing the government mandate

This interim report on the government mandate has been carried out by a project group at SwAM's Unit for the Marine Environment and a steering group contributing to the strategic direction of the mandate. SwAM has had support in the process management and administration from the consultancy company Sweco.

Before the interim report, dialogue was held with other agencies such as the Environmental Protection Agency, the Transport Agency, the Maritime Administration, the Chemicals Agency and the Energy Agency. The Swedish Boat Union (*Svenska Båtunionen*), Sweboat, Keep Sweden Tidy (*Håll Sverige Rent*) and Happy Boat have also been given the opportunity to comment on the report and the proposed measures.

3.1 Survey of recreational boats from a lifecycle perspective

The core aim of this interim report has been to conduct a survey on the extent of derelict and abandoned recreational boats from a lifecycle perspective.

3.1.1 *Point of departure for the survey*

In the survey of derelict and abandoned recreational boats, it has been crucial to take several variables into account (Virgin, et al., 2023). The most important aspects of the survey have related to size, material and age, since these factors give the best indication of the status of boats and their environmental impact. This involves estimating current environmental impact and how it may develop in the future. However, estimating the number of recreational boats in Swedish waters has not been easy. During the 20th century, recreational boats have become a natural part of many Swedes' lives. Many boats are sold second-hand, as they have a relatively long life span. Boats in use today are therefore of widely varying ages, and in some cases they are on the verge of becoming derelict or have already reached the end of their useful life.

The background report produced on assignment by SwAM has estimated a higher the number of recreational boats than the Transport Agency's Boat Life survey (2021). The two estimates should not be seen as contradictory or in conflict with each other. The difference should be seen

as a result of the present survey carrying out a deeper analysis based on the Transport Agency's estimates. The estimate in this survey is an accumulated calculation based on the estimated number of recreational boats sold in Sweden since the mid 20th century.

3.1.2 Survey of recreational boats worldwide

The problem of derelict and abandoned recreational boats is not unique to Sweden. Countries where studies of the issue have been carried out tend to be countries with a large number of recreational boats. Apart from the USA with its 15.8 million recreational boats and Canada with 8.6 million, the Nordic countries stand out in terms of the number of boats (Virgin, et al., 2023). A study conducted in 2013 showed that there were close to three million recreational boats in the Nordic countries of Sweden, Norway, Finland and Denmark (Eklund, 2013). This is approximately half of the estimated number of boats in EU (ICOMIA, 2007; EBI, 2023).

An estimated 1–2 percent of the six million recreational boats in the EU reach the end of their life span every year (EU, 2017). The number of abandoned recreational boats in the EU is estimated at 7,000–24,000 annually. The majority of these are abandoned in harbours or on land.

3.1.3 Mapping of measures to manage end-of-life boats in other countries

Measures to manage derelict and abandoned recreational boats have been carried out in several countries. In many cases, this involves registers of recreational boats, recycling alternatives and EPR schemes. See below for some examples.

The Finnish industry organisation Finnboat and the recycling company Kuusakoski established a programme in 2005 through which old recreational boats could be collected and recycled. In 2006, 250 boats were collected out of an estimated 3,000 leaving the user phase annually and becoming derelict (ICOMIA, 2007). With a total fleet of 750,000 boats at that point in time, it was estimated that about 0.4 percent needed recycling each year. Kuusakoski's recycling process has the following steps: collection and transport, pre-treatment (removal of hazardous substances), crushing, transportation to three central locations for further treatment, fragmenting and deposit. The costs of Kuusakoski's process were covered by the boat owner (Stockholms stad, 2011).

In 2017, Norway amended its regulations and economic support for promoting the collection and correct waste treatment of derelict recreational boats, and for reducing littering and environmental risks connected to boats (Miljødirektoratet, 2022). The system is operated by the Norwegian Environment Agency, and gives NOK 6,000 per tonne to municipalities for smaller recreational boats and NOK 11,000 per tonne to facilities that are permitted to deal with larger recreational boats. The waste regulation was amended in 2017 with a chapter stating that smaller (private) recreational boats up to 4.5 metres (without inboard motors) may be taken free of charge at municipal waste centres. Since derelict recreational boats are thereby defined as household waste, the costs for municipalities can be covered by the mandatory annual waste fee (Lovdata, 2017).

Norway also has a voluntary boat register. In 2023, however, the Norwegian Government started an evaluation of establishing a mandatory register for recreational boats under 15 metres. The Norwegian Maritime Authority (*Sjøfartsdirektoratet*) was assigned to evaluate the effect of a mandatory boat register and how it should be organised. The Authority delivered the first part of its assignment in June 2023, recommending a mandatory duty to register all commercial ships

under 15 metres, all recreational boats over 4.5 metres and all recreational boats – regardless of length – with a motor power above 25 HK/19 kW (Sjøfartsdirektoratet, 2023). The second part concerns a suitable arrangement for creating and operating such a register. The latter report includes proposals for necessary changes to legal rules and whether the register should be operated by a public or private actor. A number of relevant industry organisations proposed in 2018 that a mandatory boat register should include an EPR scheme financing the collection and waste treatment of derelict recreational boats (Avfall Norge, 2018). The model suggested an annual payment through the mandatory register instead of the one-off payment applied in other EPR schemes, such as in France.

In France, an EPR scheme was established in 2019. The rules involve all actors that bring recreational boats into the French market being responsible for contributing towards recycling and waste management (APER, 2021). The French industry organisation for producers of recreational boats therefore founded the organisation APER,¹³ which includes 26 recycling facilities and 97 member companies that recycle boats into several different products. APER is also responsible for sharing information and reporting to the French Ministry of the Environment and Finance.

3.1.4 Size and characteristics of the boat stock in Sweden.

The survey has identified that a clear majority of recreational boats in Sweden are small boats, for example rowing or day trip boats. They are powered by sails, oars or smaller outboard motors with power of up to 10 hp. Moreover, a large proportion of these recreational boats are more than 30 years old, while the mean life span of recreational boats is 42 years. This means that the large quantity of plastic boats sold from the mid-1960s until the 1980s have recently reached the end of their life and can be expected to need recycling (Virgin, et al., 2023). The survey's estimates correspond to the 2020 Boat Life survey and the European Commission's estimates (2017). The estimated numbers of seaworthy boats also correspond between the three reports, albeit with a slight difference in extent, which can be attributed to reports having been produced some years apart and using different methods. The distribution of end-of-life recreational boats is shown in Figure 5.

¹³ Association pour la Plaisance Eco-Responsable

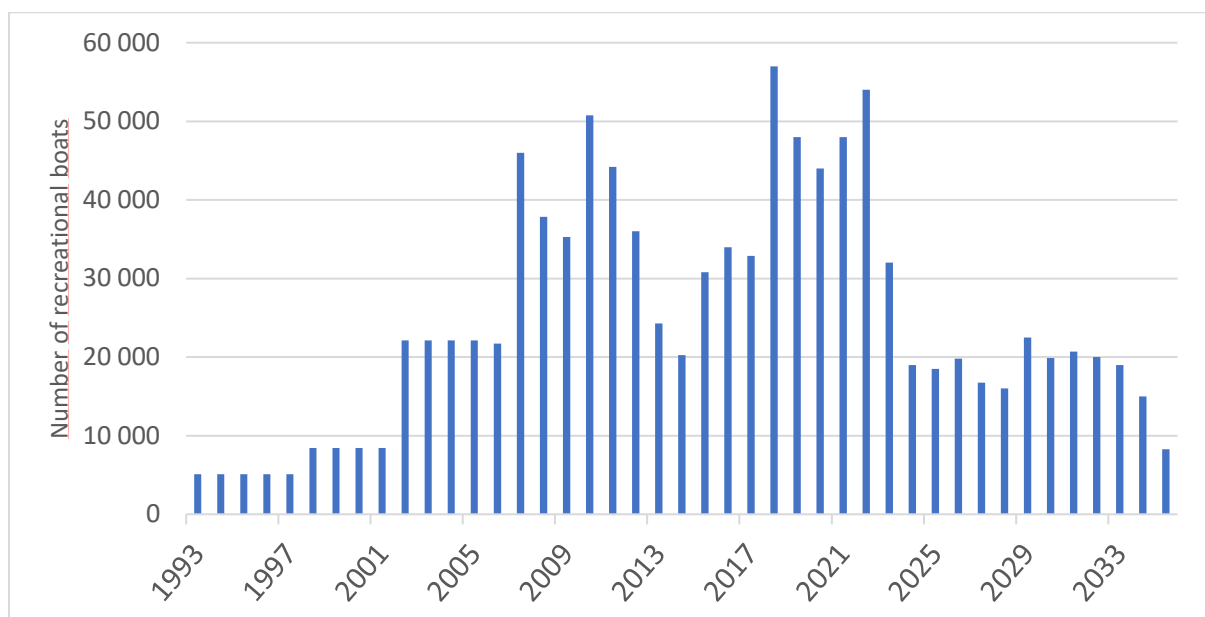


Figure 5. Number of recreational boats estimated to have reached the end of their life (Virgin, et al., 2023)¹⁴.

The survey's figures are based on calculations of the accumulated number of boats sold in Sweden since the mid 20th century, and the fact that only a few recreational boats are collected via recycling centres – approximately 25,000 in total since 1950. According to the survey, there could be up to 400,000 recreational boats in Sweden that are derelict and have not been addressed yet (Virgin, et al., 2023). A large proportion of these boats are estimated to be made of GFRP. The numbers in the survey are based on the number of boats sold over time in relation to insufficient data on second-hand sales and possible recycling.

3.1.5 Survey of recreational boat wrecks

The survey shows that a dominant proportion of the recreational boats judged to be derelict are found on land. These boats are often found on private land, usually in close proximity to water. However, recreational boats may also be abandoned in water and then become wrecks. SwAM has gathered information about wrecks of recreational boats in dialogue with the Maritime Administration and the Coast Guard.

SwAM has estimated the number of wrecks of recreational boats based on sea surveys carried out by the Maritime Administration. According to this estimate, there are approximately 1,350 wrecks of recreational boats on the seabed along the Swedish coastline and at the bottom of lakes. However, this is an underestimate since shallow waters (2.5–10 m) – where most wrecks of recreational boats are found – are not included in the sea survey. Prior to this report, the Maritime Administration stated that it will take a long time to gather this information since the remaining areas are the most time-consuming to survey.

¹⁴ The survey's estimates (Virgin, et al., 2023) concur with the 2020 Boat Life survey (Transportstyrelsen, 2021) and the European Commission's estimates (2017). The estimated number of seaworthy boats also corresponds between the three reports, albeit with a slight difference which is probably due to the reports being produced a few years apart and using different types of methods.



Figure 6. Surveyed wrecks of recreational boats in Sweden (Havs- och vattenmyndigheten, 2023). The number is probably an underestimate, as coastal and shallow areas (2.5–10 m) where most wrecks are found have not been surveyed yet.

Recreational boats are dumped on land or in lakes or at sea since it is cheaper to get rid of a recreational boat than to hand it over for waste management and recycling (Eklund, 2013) (Naturvårdsverket, 2021) (Laas, 2023a). When a recreational boat is not registered, it is very difficult to identify the owner. Wrecks of recreational boats with no known owner thereby become an economic problem for someone else (usually a municipality), who has to bear the costs of salvage, transportation, storage and dismantling. These boats pose a risk from a safety perspective, since they are not marked on nautical charts, and are also an environmental hazard.

3.1.6 Environmental impact of recreational boats from a lifecycle perspective.

The survey's lifecycle analysis shows that environmental impacts from recreational boats mainly occur during production and use (Virgin, et al., 2023). The production of materials used to make boats and the ongoing maintenance of recreational boats lead to significant environmental impacts compared to derelict boats. A derelict boat also impacts the environment if it is left on land or in water. See section 2.5 for further information about the environmental impacts of recreational boats.

A lifecycle perspective means that the environmental impacts of a product are analysed throughout all its stages. For a boat, this involves four overarching stages: production, propulsion, maintenance and finally waste (also termed 'end of life'). For recreational boats, there can be significant differences depending on the type of boat. The environmental impact can vary as a result of choices in terms of hull material, fuel and maintenance. For example, a small wooden rowing boat has a smaller impact than a cabined motorboat made of GFRP at all stages of the lifecycle. The survey shows that boats made of GFRP pose a particular environmental challenge, since existing techniques to recycle their hulls are not used in Sweden.

In the work involved with the survey, methods to enhance sustainability among producers of recreational boats have been identified. The development process is focused on sustainability with regard to choice of material, hull design and alternative fuels.

3.2 Current legal position on managing recreational boats

To be able to manage derelict and abandoned recreational boats, an insight in the current legal position is needed. Primarily, the two reports of the judicial inquiry have taken into consideration the responsibility and authority of different actors. The point of departure for the judicial inquiry has been to investigate the responsibility and authority of government agencies and municipalities to deal with derelict and abandoned recreational boats (Laas, 2023a). Thereafter, the judicial inquiry has investigated whether these responsibilities can be clarified in relation to one another to facilitate the management of derelict and abandoned recreational boats (Laas, 2023b). For the purposes of the inquiry, it has been essential to consider the many different actors affected by changes in legislation. This includes public actors as well as industry, non-profit organisations and private individuals who may be affected by changes to rules regarding handling recreational boats.

The following section begins with a definition of responsibility and authority, before presenting the reasoning laid out in the judicial inquiry (Laas, 2023a). Then follows an in-depth presentation of the responsibility and authority of different actors involved in dealing with recreational boats.

By 'responsibility', SwAM means the legal provisions that make agencies or municipalities responsible for an issue or an area. This involves an agency being assigned to manage the issue. Agency responsibilities are detailed in regulations (*förordningar*) or letters of appropriation (*regleringsbrev*) decided on by the Government. An example is section 1 of the regulation with instruction to SwAM, where it is stated that SwAM "[...] is the administrative agency within the area of environment for the protection, restoration and sustainable use of lakes, watercourses and the sea" (2011:619).

'Authority' means the interpretation and implementation of an actor's explicit responsibility. This authority may be a result of case law or based on guidance from another agency. It also includes an actor's scope to act within a specified area, and how the actor itself has interpreted its possibilities to act.

3.2.1 Agencies' responsibilities for recreational boats

The in-depth judicial inquiry (Laas, 2023b) has identified five agencies with explicit responsibilities in areas related to recreational boats. These responsibilities primarily concern rules governing

propulsion, safety and environmental impacts (such as anti-fouling and emptying of boat latrines). The five agencies and their respective areas of responsibility regarding recreational boats are:

The Swedish Agency for Marine and Water Management: A focus on sustainable use in the marine environment, with overarching goals of achieving good environmental status in the marine environment and reduced environmental impact from human activities such as recreational boats.

The Coast Guard: Prevent crime and ensuring order at sea.

The Environmental Protection Agency: Waste management and circular economy.

The Maritime Administration: Compiling geographic information about the sea and providing certain grants for recreational boating, and the possibility to move wrecks if owners refuse to do so, although this possibility is limited.

The Transport Agency: Waste management, reduced pollution from boat motors, rules for producing and importing recreational boats, the presence of TBT and Irgarol on hulls, removing old anti-fouling, and issuing driving licences for jet skis. The Transport Agency maintains a mandatory register of commercial vessels and a voluntary register of recreational boats under 15 metres.

None of the five agencies has an explicit responsibility for the whole lifecycle of recreational boats. As for the Coast Guard and the Transport Agency, recreational boats have not been mentioned in their respective letters of appropriation (*regleringsbrev*) since 2018. The Maritime Administration receives a small grant to cover costs related to recreational boats (*ramanslag*). This grant may be used within the Administration's responsibility for costs that are not covered by commercial shipping. Beside the agencies mentioned, the Swedish Police Authority may also be involved in managing recreational boats. According to the in-depth judicial review, the police are most often involved when crime is suspected in cases such as drunk driving, handling of wrecks (*sjöfynd*) or littering (Laas, 2023b).

In several of the ordinances providing terms of reference for the agencies, it is evident that they are responsible for cooperating on issues which require cooperation, including issues regarding water and the environment. Here, the Environmental Protection Agency and SwAM have particular responsibilities. According to section 4 of its instructing ordinance (2012:989), the Environmental Protection Agency shall initiate cooperation between agencies to guide supervision when needed. The in-depth judicial inquiry states that:

"[In] the environmental supervision regulation, it is said that the supervision guidance agencies shall cooperate on issues of supervision guidance to promote efficient and uniform supervision. The Environmental Protection Agency should (according to the Ordinance on Environmental Supervision (2011:13)) initiate cooperation. The Swedish Agency for Marine and Water Management shall cooperate with other agencies when needed to deal with issues relating to the marine and water environment (2011:619)" (Laas, 2023b, s. 16).

Many issues regarding derelict recreational boats lie at the intersections of different agencies' responsibilities. Thus, continued cooperation between the Environmental Protection Agency, SwAM and the Transport Agency in particular is necessary.

3.2.2 The owner is responsible for a recreational boat, but may be unknown

As with other vehicles, the point of departure is that the owner of a recreational boat has the sole right to use, handle and move the boat. This includes salvage and dismantling when the owner deems the vehicle derelict. With recreational boats, salvage and dismantling usually involve costs for the owner. This, in turn, can lead to derelict recreational boats being abandoned or even sunk instead of being recycled (Laas, 2023a). If a recreational boat is abandoned, an environmental problem occurs which requires other actors to act despite the responsibility of the owner.

If the owner of a recreational boats abandons or sinks their boat, the issue of responsibility becomes complicated since there is no register of recreational boat ownership. Thus, identifying owners is difficult. The judicial inquiry mentions that, in talks with boat clubs and harbours, examples of boats being dumped on their grounds have been mentioned. The responsibility for dealing with the boat, including related costs, then falls upon the boat club or the harbour owner, in their capacity as landowners.

According to the judicial inquiry, the responsibility for managing derelict and abandoned recreational boats lies with the landowner if they have approved or accepted the placement of a recreational boat on their property. Certain difficulties arise when agencies or municipalities are landowners. Only under limited circumstances are agencies or municipalities able to manage derelict and abandoned recreational boats. Consequently, agencies or municipalities must resort to time-consuming processes to deal with these boats, including in cases where a private landowner has not authorised or accepted the placement of a boat. The in-depth judicial inquiry has identified that new interpretations of existing legislation and clarified responsibility may suffice to address the legal obstacles managing derelict and abandoned recreational boats (Laas, 2023b).

3.2.3 Producers' potential responsibility within the EU

The Environmental Protection Agency proposed an EPR scheme in its report of 2011, as part of a national solution for dealing with recreational boats. An EPR scheme is supposed to reduce the amount of waste. In 2023, the EBI proposed an EPR scheme at EU level. Both the Environmental Protection Agency's proposals and the EBI's proposals are based on the idea that producers of recreational boats should be encouraged to develop products that are resource-efficient, easy to recycle, and free from hazardous substances. When and in what form an EPR scheme may be realised within the EU has not been discussed yet. In this government mandate, an EPR scheme is also proposed.

EPR has been implemented in several other areas within the EU. In the Waste Framework Directive (2008/98/EG), an EPR scheme is defined as "a set of measures taken by Member States to ensure that producers of products bear financial responsibility or financial and organisational responsibility for the management of the waste stage of a product's life cycle". Recreational boats are not included in the present Waste Framework Directive. Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment (also known as the Directive on single-use plastics) has also introduced EPR schemes for several plastic products, such as single-use packaging and fishing gear made of plastic. To implement this directive, the Environmental Protection Agency was assigned to propose measures to increase plastic recycling, published in a report (2021).

3.2.4 *Recreational boats as sea finds or lost property*

Section 3.2.2 describes the importance of ownership for possibilities to manage recreational boats and to make decisions on dismantling or recycling. The judicial inquiry identifies two pieces of relevant legislation: the Act on Certain Provisions Regarding Finds at Sea (the Sea Finds Act) and the Act on Finds. According to the legislation, the owner is primarily responsible for taking care of their property. However, there are options for several agencies to deal with boats (Laas, 2023a).

According to the Sea Finds Act, the party who salvages a boat at sea or washed up on a beach should report the find to the police, the Coast Guard or customs. An owner thereafter has 90 days to make themselves known before the find goes to the salvager. This provides an opportunity for agencies and municipalities to scrap boats after 90 days if the salvager does not wish to keep the boat (Laas, 2023a).

In contrast to the Sea Finds Act, the Act on Finds does not restrict where a find can be made. Lost property (*hittegoods*) is defined as property that is not in anyone's possession. For recreational boats, this could mean that the boat is in a place where the owner cannot be expected to leave it. According to the judicial inquiry, the police have tried to use this law on several occasions when dealing with boats, but have subsequently been judged to have acted on incorrect grounds. The Office of the Chancellor of Justice has ruled that the police have ventured too far in relation to property rights.

Who is assigned the responsibility for managing abandoned boats and ensuring they do not remain abandoned on land or in water is, in practice, a slightly unclear issue. According to the judicial inquiry, the municipalities are ultimately responsible, as no other responsible actor can be pointed out (Laas, 2023a).

3.2.5 *Recreational boats as litter or waste*

Another possibility in terms of responsibility for derelict or abandoned recreational boats is to consider when boats can be deemed to be litter or waste. In the following section, these interpretations and current sections of law are presented along with related challenges.

Litter is, according to the interpretation of the Environmental Protection Agency, when different kinds of objects are thrown away or left on the ground. Larger objects such as white goods, furniture and construction waste are also included (Naturvårdsverket, 2013). Littering is a crime which has negative impacts on our environment. There is a common definition of waste within the EU:

"Waste means any substance or object which the holder discards, or intends to or is required to discard"
(Naturvårdsverket, 2020).

Chapter 15, section 26 of the Swedish Environmental Code (1998:80) forbids littering, which may occur when a boat is left either in water or on land. According to the judicial inquiry, the Environmental Code means something may be regarded as litter regardless of whether or not it is actually waste – it is enough that the boat is considered an eyesore and constitutes litter (Laas, 2023b).

When a crime is suspected, including littering, the police may be involved. If the owner of a recreational boat cannot be identified, however, the police will close their investigation since they are unable to take legal proceedings against anyone. The in-depth judicial inquiry establishes that it is possible to clarify the responsibility and adjust certain interpretations in order to partly address the legal obstacles to dealing with recreational boats (Laas, 2023b).

3.2.6 Developed guidance for municipalities is a way forward

When managing abandoned and derelict recreational boats, municipalities have some responsibility to act. According to the in-depth judicial inquiry, they currently lack the obligation to act or deal with boats (Laas, 2023b). In the Environmental Protection Agency's current guidance for municipal waste, recreational boats are not considered household waste (2023). Thus, the municipalities are not obliged to manage derelict boats at their waste facilities. Nor does any other actor have an explicit responsibility to accept waste in the form of derelict recreational boats. How recreational boats should be addressed is a legal gap at present.

The in-depth judicial inquiry proposes that developing the guidance on littering may enable municipalities to deal with recreational boats under the littering regulations (Laas, 2023b). There is a lack of systematic handling of recreational boats that constitute litter. There is currently one private initiative to create nationwide scheme for the reception of recreational boats for dismantling. This has, in part, been financially supported by SwAM, but is not supported by applicable law.

To bring about such a change, the Environmental Protection Agency needs to contribute guidance for the municipalities. In the in-depth judicial inquiry, Laas justifies his analysis as follows:

"A central task for the environmental government agencies is to provide supervision guidance to supervising agencies. The Regulation on Environmental Supervision (*miljötillsynsförordning*) describes the responsibility for operational supervision and supervision guidance. The regulation refers to a number of specific situations in which certain agencies are highlighted as being responsible. In the case of derelict recreational boats, the municipalities are the primary regulatory authority and therefore need guidance to fulfil their duties as good as possible" (Laas, 2023b, s. 14).

Municipalities thus have a responsibility for recreational boats, but it is legally unclear in which situations and to what extent. They should, however, receive support from the Environmental Protection Agency and SwAM for dealing with recreational boats. The Environmental Protection Agency can provide support and control in its supervision of municipal work relating to littering, especially under the Act with Particular Provisions on Street Maintenance and Signs.

According to the judicial inquiry, SwAM's supervisory responsibility for environmental quality standards and dumping can be expanded to include derelict recreational boats (Laas, 2023b). SwAM itself, however, is of the opinion that this supervisory responsibility requires formal expansion, since the current legal framework does not mention recreational boats.

3.2.7 Municipal authority

In the previous section, the responsibility of actors who are able to manage derelict or abandoned recreational boats was presented. The basis for action needs to be accompanied by legal authority. The judicial inquiry has primarily focused on municipalities' opportunities to hold owners accountable for dealing with boats that constitute litter. In cases where the owner fails to act, the

municipality may need to salvage and scrap boats. However, in these cases the present legal position prevents municipalities from taking efficient action, as they must abide by the bureaucratic laws on lost property, the Sea Finds Act and the Act on Finds, which are not suited to manage derelict and abandoned boats (Laas, 2023a).

The judicial inquiry has identified that municipalities' opportunities to act when the owner of a boat that constitutes litter is known are based on supervision in accordance with the Environmental Code. Municipalities are responsible for waste management within their municipal boundaries. Supervisory authority is set out in chapter 26 of the Environmental Code (1998:808), and the primary instrument involves issuing injunctions based on chapter 26, section 3 to make owners deal with their boats.

Figure 7 summarises legal and other challenges in the lifecycle of recreational boats, as identified in the two judicial inquiries, along with suggested measures for handling the challenges. On the whole, the suggested measures are in line with SwAM's proposals – see section 5.

Further, the judicial inquiry establishes that municipalities may be responsible for boats that constitute litter (section 4 of the Act on Street Maintenance) when an owner cannot be identified. When owners are unknown, the municipality's authority to move a boat is still limited due to property rights. Even with boats that constitute litter, the municipalities cannot immediately move or scrap them. In order to move a boat, a formal lost property report must be submitted, after which the boat becomes municipal property if the owner has not been found in 90 days' time. Hence, there is a discrepancy between the responsibility to deal with the problem and the legal authority to take swift and efficient action.

Municipalities have the right to move wrecked vehicles on land in accordance with the Act on Moving Vehicles in Certain Cases. 'Wrecked vehicles' are vehicles which, due to their condition, the time they have been in the same location and other circumstances, must be considered abandoned and which obviously have little or no value. At present, no such possibility exists regarding boats. In the in-depth judicial inquiry, Laas identifies a possibility to amend the law on moving vehicles to include the right to move derelict and abandoned recreational boats (Laas, 2023b). This would increase the municipalities' authority compared to today.

THE LEGAL LIFE CYCLE OF BOATS



Figure 7. Summary of the links between the phases of the recreational boat lifecycle, the legal challenges and the proposed measures of the in-depth judicial inquiry. (Laas, 2023b).

4 Discussion

The problems regarding recreational boats are complex. There are already many abandoned and derelict recreational boats on land and in water. Most of these boats were made many years ago from plastic. On top of recreational boats being a waste and littering problem, they may also be hazardous to the environment as a result of releasing microplastics or hazardous substances. From measurements of TBT in the marine environment, it is evident that thresholds for good environmental status regarding TBT are not reached. In view of the many existing abandoned and derelict recreational boats, it is safe to say that there is a backlog of boats to handle.

More boats are currently being abandoned than dismantled, and the numbers are expected to increase in the near future since many will soon reach – or have already reached – the end of their lifespan. This means that the number of abandoned and derelict recreational boats will increase if nothing is done, and the need for a long-term solution is more urgent than ever. As these boats can rarely be connected to an owner who can be held accountable for dealing with the problem, a solution needs to be found among agencies and municipalities. As stated in the previous sections, the legislation is not adapted to the current situation, as agencies and municipalities lack the legal authority to act on derelict and abandoned recreational boats to combat waste and littering. Addressing the problem will be costly for municipalities.

As the backlog is addressed, parallel actions need to be taken to prevent future problems of the same kind.

Handling derelict and abandoned recreational boats as waste has not previously been addressed from a holistic perspective. Many of the recommendations and legal rules have primarily focused on the use and maintenance of recreational boats, not on taking care of them once they have been deemed derelict. The owners are accountable for their recreational boats, but since tracking owners is difficult, the municipalities must often bear the costs of boats that constitute litter despite recreational boats not being considered municipal waste. Many boats need to be addressed, but few actors work actively with receiving recreational boats at waste facilities. The efforts made are mostly selective measures, such as subsidies from SwAM to scrap boats. Without these subsidies it is relatively costly to scrap a boat.

Moreover, the opportunities to recycle recreational boats are limited. Many older boats contain GFRP, and there is a lack of knowledge about recycling possibilities. The identified problems are multi-dimensional and require various measures to solve.

Internationally, SwAM has observed an increasing attention being paid to the management and recycling of recreational boats, both within the EU and in other international contexts such as OSPAR, HECLOM and IMO. Driving factors include the clear connections to issues of plastics and waste. By international comparison, Sweden has many recreational boats and thereby a relatively large number that become derelict or are abandoned. Earlier in the 21st century, Swedish authorities have carried out two investigations into problems related to derelict and abandoned recreational boats. Both *Wrecks and ownerless boats* (the Swedish Agency for Public Management, 2008) and *Littering and derelict recreational boats* (the Swedish Environmental Protection Agency, 2011) proposed a register of recreational boats and an EPR scheme. However, the proposals from these investigations have not been implemented. Since the investigations were presented more than ten years ago, not much has happened apart from SwAM financing dismantling derelict recreational boats since 2018. The number of collected

boats does not correspond to the estimated number of boats that need to be addressed. Moreover, the problem of derelict recreational boats has probably increased since the earlier investigations, since a large proportion of the present stock of recreational boats has now passed the expected lifespan of 40 years.

To address the issue of collecting and recycling recreational boats, several types of measures are needed. On a national level, the responsibilities need to be clarified in order to address the issue more systematically. Further, amendments to laws are needed to give the municipalities and agencies increased authority to deal with derelict and abandoned recreational boats.

The proposed legal amendments should be implemented with regard to minimising possible increased costs for municipalities. Thus, subsidies to the municipalities are proposed to cover the costs of handling abandoned recreational boats and wrecks. To address the issue of dismantling and recycling, several perspectives need to be considered. The historic debt of abandoned and derelict recreational boats needs to be addressed, and public funding is expected to be needed for an extended period in order to scrap these boats.

Alongside measures to deal with current problems, other types of systematic action are needed to prevent future problems. Several issues related to abandoned and derelict boats are made more difficult because of the owner being primarily responsible, but also often not being known to the authorities. A register of recreational boat ownership is therefore proposed. A previous register of recreational boats was dismantled in the 1990s. Since then, the problem of abandoned and derelict recreational boats has grown, and the environmental impact of plastics and TBT has been highlighted. A point of departure for future systems to deal with recreational boats should be that dismantling and recycling are not publicly financed, but should be funded in line with the polluter pays principle. In this case, the polluter is not only the last owner. The rules should ensure that all boat owners contribute, so that recycling costs are covered once the boat reaches the end of its life, especially since the last owner's economic accountability goes beyond existing EPR schemes. Thus, an EPR scheme for recreational boats is proposed in the long term.

In parallel with what is stated above, work is needed on knowledge and development, especially in connection with handling and recycling materials. There is a need for knowledge about recycling plastics in old boats and the development of future boats to enhance circularity. One possibility is to include the choice of materials and recycling instructions in the Recreational Craft Directive (2013/53/EU) which regulates the production of boats, forcing boat producers in the EU to follow equal demands. There is also a need for more detailed knowledge about environmental consequences and which legal rules may present hurdles to circular models for recreational boats. Knowledge synergies should be sought, and have been identified in the form of wind turbine rotors. Cooperation between actors and agencies needs to increase in order to tackle the challenges described.

The proposals presented below are deemed to be well in line with national sustainability work, and involve issues including plastics, cleaner oceans, non-toxic environment, waste disposal and a circular economy.

5 Proposed measures to recycle more recreational boats

Here, the Swedish Agency for Marine and Water Management presents the proposed measures deemed necessary to recycle more recreational boats in Sweden. These measures are divided into three areas. The first proposed measures focus on managing derelict and/or abandoned recreational boats. These are followed by proposed measures for recreational boats in use today or sold in the future. Finally, overarching measures are proposed for further knowledge gathering and development regarding recreational boats in Sweden.

5.1 Proposed measures for abandoned and derelict boats

The judicial inquiry has identified a vague distribution of responsibility regarding the management of abandoned and derelict recreational boats. According to present law, neither municipalities nor government agencies have an explicit responsibility to handle derelict and abandoned recreational boats (Laas, 2023a). SwAM therefore judges that a change is needed to ensure improved handling. SwAM proposes that clarifications can entail the state undertaking to collect and recycle recreational boats, as well as describing the municipalities' responsibilities and authority to act. A proposed legal amendment to increase municipal authority is also presented.

5.1.1 *A long-term recycling system for recreational boats*

The Swedish Agency for Marine and Water Management proposes that the government secures a long-term undertaking for the collection, dismantling and recycling of recreational boats.

To handle the large number of recreational boats that are already derelict and abandoned, funding and a long-term state undertaking are needed, similar to the work carried out by SwAM today involving dismantling campaigns for recreational boats.

SwAM proposes an EPR scheme for the full lifecycle of recreational boats, to be in place by 2030. Prior to that, a yearly budget decision by the Government is proposed to secure a long-term recycling system for recreational boats, similar to the work relating to hazardous wrecks (Havs- och vattenmyndigheten, 2019). Further, SwAM proposes that the earmarked funds should be shared between managing and recycling boats, enhancing knowledge about environmental risks and developing recycling methods and choices of material.

In the current dismantling campaigns, which expire in 2024, municipalities and private individuals are given the opportunity to scrap and recycle recreational boats without cost. However, the cost of transporting boats is not included in the subsidies, which should be reviewed.

As part of long-term work to collect, scrap and recycle recreational boats, clear information for boat owners should be included, informing them how to act and who to contact throughout the collection and recycling process.

SwAM also proposes that the procurement process should promote national and local actors who are able to handle recreational boats in an environmentally safe way, as well as promoting innovative methods for recycling recreational boats, such as pilot projects on recycling and reusing plastics, and new logistical solutions.

5.1.2 *Clearer responsibility and authority for municipalities to act*

5.1.2.1 **Increased authority to move derelict and abandoned boats**

The Swedish Agency for Marine and Water Management proposes legal amendments to give municipalities increased authority to move and manage abandoned and derelict recreational boats.

Current legislation is not suited to the present situation, with increasing numbers of recreational boats not in use and in different states of decay. By giving the municipalities increased authority, and thereby better opportunities to manage derelict and abandoned recreational boats, SwAM sees that several of the problems relating to complicated procedures for moving and dismantling boats can be resolved.

At present, agencies and municipalities are referred to the Act on Certain Provisions Regarding Finds at Sea or the Act on Finds in order to become owners and thereby gain authority, or to rules under certain circumstances giving the right to move and eventually scrap boats. Many of the currently abandoned and derelict recreational boats do not, however, fall within the present interpretation of finds at sea, and cannot thus be addressed. Moreover, the Sea Finds Act is not aimed at dismantling derelict boats, but relies on the idea that there is someone interested in owning the boat.

Both the Environmental Protection Agency and the Ministry of Environment have previously proposed legal amendments regarding moving boats under certain circumstances. Differences between their proposals included the Ministry of Environment proposing a new law on moving boats, rather than amending the existing law on moving vehicles. According to the memorandum of the Ministry of Environment, there was:

“... a need for supplementary legislation to give the state or a municipality the clear authority to move a boat in cases where this can be deemed necessary” (Miljödepartementet, 2012, s. 13).

SwAM proposes a new regulation giving the municipalities a clearer authority to move and taking care of derelict and abandoned recreational boats. This regulation may be based on the proposals from the Environmental Protection Agency (2011) and the Ministry of Environment (2012), both of which were circulated for consultation.

5.1.2.2 **Subsidised costs for managing derelict and abandoned boats**

The Swedish Agency for Marine and Water Management proposes subsidies to municipalities for moving and dismantling derelict and abandoned recreational boats.

In cases where the owner cannot be held accountable for the costs of moving and dismantling a recreational boat, significant costs may be incurred by municipalities for moving and dismantling recreational boats. The cost differs considerably between municipalities. Coastal municipalities are generally home to more abandoned and derelict recreational boats. Thus, some kind of subsidy for municipalities to meet the costs of moving and dismantling recreational boats can be justified. Alongside the proposal to increase the municipal authority to move and deal with derelict and abandoned recreational boats, SwAM suggest that subsidies for municipalities should be introduced to cover the costs arising when exercising this new authority.

At present, municipalities can apply for subsidies from the Environmental Protection Agency for costs in connection with relocating, storing and dismantling wrecked vehicles that are relocated under the Act on Relocating Vehicles in Certain Cases. SwAM proposes that a similar subsidy should be introduced for recreational boats relocated under the new regulation.

5.1.2.3 Developed guidance for municipal responsibility

The Swedish Agency for Marine and Water Management judges that the municipal responsibility for recreational boats that constitute litter in accordance with the Act with Particular Provisions on Street Maintenance and Signs needs clarification and developed guidance for municipalities within this area of law.

One obstacle to efficient handling of recreational boats that constitute litter is that the responsibility for the problem is not clearly described in the legislation, apart from the owner's responsibility to take care of the boat so that it does not litter or create other problems. This, in turn, leads to difficulties as the owner is often unknown. Another problem is that it may be unclear to the municipalities at which point a boat can be considered to constitute litter (Laas, 2023a).

Municipalities have a responsibility for cleaning up, in accordance with the Act with Particular Provisions on Street Maintenance and Signs (Naturvårdsverket, 2013). Under this act, the municipalities have a general responsibility to keep areas accessible to the public in a state that, with regard to local conditions, the position of the site and other circumstances, meets reasonable claims. This responsibility is subsidiary, meaning that if someone else can be held accountable, the municipality's responsibility lapses. If the owner of a boat that constitutes litter is known, the municipalities can order them to move the boat. As described above, the owner is often not known. Municipalities need to wait for a boat to be considered to constitute litter before their authority to act applies. Another problem is that the connection to boats that constitute litter is weak in the Act with Particular Provisions on Street Maintenance and Signs.

SwAM judges that there is a need to clarify municipal responsibility for boats that constitute litter under the Act on Street Maintenance, for example clarifying the connection between the definition of litter, the Act on Street Maintenance and the responsibility in greater detail. How municipal responsibility relates to other actors such as boat owners, landowners and operational practitioners also needs clarification, since the municipal responsibility is secondary.

There is a need for developed guidance from the Environmental Protection Agency on the application of the Act on Street Maintenance to assist the municipalities in understanding their role, both in a supervisory capacity and in their own responsibility for cleaning up. There is also a need to clarify when a recreational boat is considered to constitute litter, not to expand the municipal responsibility but to clarify the existing responsibility under the Act on Street Maintenance and the opportunities to act. Clarifying the municipal responsibility regarding recreational boats that constitute litter may facilitate municipal handling of the issue and lead to more recreational boats that constitute litter being addressed.

5.1.2.4 Opportunities for municipalities to remove recreational boats

The Swedish Agency for Marine and Water Management proposes that municipal regulations on public order should be introduced for recreational boats at specifically designated locations.

Municipalities need clearer authority to act in connection with recreational boats in unwanted locations. SwAM suggests that municipal regulations on public order may make it easier for municipalities to remove recreational boats from specific places.

Under the Act on Public Order, municipalities can introduce public order regulations. The option is limited to public places, and thus cannot comprise all areas of a municipality. Swimming areas are mentioned as examples of locations that constitute public places. SwAM judges that there is no obstacle to municipalities introducing local public order regulations to impose restrictions on the mooring or storage of recreational boats in certain places. The municipalities would then be able to remove boats from locations where they are not allowed, in accordance with local public order regulations. There would be no need to consider whether the boat constitutes litter in order to move a boat; the fact that the boat is in a prohibited place according to local regulations would be enough.

To give the municipalities clearly increased authority and opportunities to act in connection with recreational boats that constitute litter, legal changes are needed such as the proposal for an Act on Moving Boats under Certain Circumstances (see section 5.1.2.1). Such legal changes take time. Developing local public order regulations is much more limited in effect, but could be a possibility in the short-term.

5.1.2.5 Simplifying the management of abandoned boats

The Swedish Agency for Marine and Water Management proposes to increase the application of existing exemptions in the Act on Certain Provisions Regarding Finds at Sea (1918:163) to include boats in certain cases.

SwAM judges that the long-term solution for managing recreational boats that constitute litter is a regulation on moving of boats under certain circumstances (see 5.1.2.1). Other adjustments to existing laws are also needed to improve their suitability. The Act on Certain Provisions Regarding Finds at Sea (1918:163) is one such example, giving authorities opportunities to taking care of abandoned boats in certain cases.

The Act on Certain Provisions Regarding Finds at Sea (1918:163) includes sunken, drifting or beached boats. The act places demands in terms of issuing public notices and searching for the owner before the find goes to the salvor, with exemptions when the value of the find is below SEK 100. One way to facilitate the management of derelict and abandoned recreational boats would be to increase these exemptions, for example by raising the value limit so that more recreational boats would be considered worthless and consequently be easier for municipalities to handle. This would bring benefits in the form of reduced administrative burden on municipalities and the police. Note that the Act on Finds at Sea only covers abandoned boats, and thus has a limited scope.

5.2 Proposed measures for seaworthy and future recreational boats

To ensure that more recreational boats are addressed appropriately in the future, SwAM presents proposals to facilitate the management of seaworthy recreational boats. SwAM proposes the introduction of a register of recreational boats, and a further investigation into an EPR scheme for recreational boats.

5.2.1 A register of recreational boats should be introduced

The Swedish Agency for Marine and Water Management proposes that the Government mandates the Transport Agency to investigate the design of a register of recreational boats.

Since the discontinuation of the previous Swedish mandatory register of recreational boats in 1992, the issue of reintroducing such a register has been raised on several occasions. The Environmental Protection Agency proposed a register in its report *Littering and Derelict Recreational Boats* in 2011, and the committee on Sweden's environmental objectives has proposed a register in its report *The sea and the human* (SOU 2020:83). The investigation *Amended rules on jet skis* (SOU 2022:49) also proposed that the Transport Agency should investigate the conditions for introducing a register for jet skis.

In the Ministry of the Environment's memorandum (M2012/1824/R), however, a new register of recreational boats was not recommended due to the costs of a register not being proportionate to the benefit, the fact that register markings on a boat may be removed, and the suggestion that a register may infringe upon personal privacy.

In the decade since the memorandum was written, the conditions have changed and knowledge about the environmental impact of abandoned boats has increased. From an environmental perspective, the benefits of a register of recreational boats outweigh the costs of introducing and maintaining such a register. Since the previous investigations, the problem of derelict and abandoned recreational boats has increased markedly as a large proportion of the present stock of recreational boats was sold between 1960 and 1980, and has thus exceeded the expected mean lifespan of 40 years.

According to the survey, up to 400,000 recreational boats in Sweden could be derelict, with up to 35,000 of them abandoned (Virgin, et al., 2023). The main reasons for the many abandoned recreational boats are difficulties identifying owners and the high cost of waste management, resulting in boats being dumped and sunk. Recreational boats with unknown owners thereby become an economic problem for someone else (usually a municipality), who must bear the costs of salvage, transportation, storage and recycling. A cost-benefit analysis for a register of recreational boats needs to include the current societal costs for waste management, especially the costs for affected municipalities.

In the absence of a known owner, recreational boats are left as litter since it is not possible to move these boats before their owner has been identified, further impacting the aquatic environment. Almost all presently abandoned boats were produced before 1989 when the biocide TBT was prohibited in anti-fouling. Thus, older boats pose a greater environmental risk since they are more likely to have been painted with anti-fouling containing TBT. TBT has been described as one of the most toxic substances ever discharged into the aquatic environment, and is one of the substances contributing to good chemical status not being achieved in Swedish bodies of water. Boat hulls are cited as one source of spreading TBT.

Moreover, the number of derelict and abandoned recreational boats is expected to increase over time, which may lead to increased environmental risk and the need to deal with these boats. Approximately 1–2 percent of all seaworthy recreational boats are expected to reach the end of their lifespan each year. In Sweden, with its 864,200 seaworthy recreational boats in 2020, this

means an increase of 9,000–17,000 derelict recreational boats per year. The average volume of composite waste per disassembled recreational boat has been calculated at approximately 0.77 metric tonnes (APER, 2023), which means that recreational boats in Sweden may generate 7,000–13,000 tonnes of composite waste every year.

A register of recreational boats would simplify surveying the population of recreational boats and improve knowledge about the extent of the problem, both in general terms and specifically for certain municipalities and marinas. There is frustration among actors such as the police, municipalities, boat clubs and marinas regarding the cumbersome work of dealing with abandoned boats under vague distributions of responsibility. According to the 2020 Boat Life survey, 80 percent of boat owners were sympathetic to the idea of introducing a register of recreational boats (Transportstyrelsen, 2021).

SwAM proposes that an investigation into the design of a recreational boat register should be established. Such an investigation should include a cost-benefit analysis and careful consideration about who should have access to the register's content.

A register of recreational boats would support increased collection and recycling of recreational boats. It is also a precondition for an EPR scheme for recreational boats.

5.2.2 Further investigation into an Extended Producer Responsibility scheme

The Swedish Agency for Marine and Water Management proposes that an EPR scheme should be further investigated.

The responsibility for recycling recreational boats currently lies with the last owner, if known. This means those who produce, sell or import boats in the Swedish market do not have a clearly stated responsibility. Unclear responsibilities and high costs of waste management result in recreational boats being dumped in natural areas. Thus, in order to increase the collection and recycling of recreational boats, it is necessary to have an end-of-life perspective on recreational boats right from the production stage, and to include recreational boats in the transition to a sustainable and circular economy.

The question of implementing an EPR scheme for recreational boats has been addressed previously by the Environmental Protection Agency (2011) and in the EBI's *Roadmap on the implementation of the circular economy for end-of-life recreational boats* (2023). The Environmental Protection Agency's report *Littering and derelict recreational boats* included proposed measures to introduce an EPR scheme for recreational boats in Sweden and to work for an EU-wide EPR. One of the conclusions was that further investigations into how the scheme should be designed are needed before such a scheme can be introduced.

"Better cost data is needed, and it may be necessary to gather stakeholders to discuss the design of the system" (Naturvårdsverket, 2011, s. 43).

SwAM supports the Environmental Protection Agency's proposal, and is of the view that an EPR scheme can solve many of the problems involved in managing end-of-life recreational boats in the future. An EPR scheme can also contribute to better knowledge about the materials used in recreational boats, and thereby increase knowledge about the plastic waste flows surveyed by

the Environmental Protection Agency (2022). An investigation into EPR for recreational boats may also result in proposals to clarify the responsibilities of various agencies regarding dealing with recreational boats.

The Ministry of the Environment judged in its memorandum (M2012/1824/R) that the question of introducing an EPR scheme for derelict boats should be investigated further. Before an EPR scheme can be introduced, one or more statutes need to be decided on to regulate the responsibilities of agencies and EPR organisations. SwAM therefore proposes commissioning an investigation into how a national EPR scheme can be designed, pending a possible EU directive on EPR scheme for recreational boats by 2030.

An important aspect of designing an EPR scheme will be the issue of financing, which should be considered within the investigation. Introducing an EPR scheme should be in line with the polluter pays principle, rather than using public funding for the collection and recycling of recreational boats. The investigation should also cover how long-term financing for information to boat owners should be secured.

5.3 Overarching proposed measures for recreational boats

To ensure that recreational boats are addressed effectively in the long term, SwAM proposes increased funds for knowledge-building and innovation to reduce environmental risk from abandoned recreational boats, and that an agency – appointed by the Government – should begin working for increased cooperation among stakeholders.

5.3.1 Increased knowledge and innovation to limit environmental risk

The Swedish Agency for Marine and Water Management proposes more funding for knowledge-building and innovation to increase recycling and limit the problem of abandoned recreational boats.

The survey of the stock of recreational boats and the investigation into environmental impact from a lifecycle perspective have highlighted several knowledge gaps (Virgin, et al., 2023). The number of derelict and abandoned recreational boats and their environmental risks are not fully quantified. The same goes for the sustainability of current recycling techniques and systems for recreational boats. The survey points out that many recreational boats currently need recycling, and that this number is expected to rise significantly in the coming years if no measures are taken.

5.3.1.1 Continued survey of recreational boats

The Swedish Agency for Marine and Water Management proposes that information about derelict and abandoned recreational boats should be included in the Transport Agency's Boat Life survey, and that the Maritime Administration's sea survey data should be analysed to more accurately estimate the number of recreational boats wrecks.

The survey included proposing and using innovative ways of working to efficiently survey where most abandoned recreational boats are located, and to identify which types of boat are abandoned in terms of factors such as size, material and age (Virgin, et al., 2023). The analysis

shows that template methods have been predominant in estimates of the number of recreational boats becoming derelict or being abandoned.

Few studies have been carried out in Sweden, and the existing estimates are often based on the Transport Agency's Boat Life survey. This survey presents a picture of boating today, compared to previous years since 2004. Data from the Boat Life survey cannot, however, be used to obtain accurate estimates of how many recreational boats need recycling. SwAM therefore proposes that the Transport Agency includes questions in future surveys which can contribute to estimating the number of derelict and abandoned recreational boats in Sweden.

Possible future methods for further surveying derelict and abandoned recreational boats would contribute to reducing the discrepancy between the accumulated number of boats on the market and the number considered seaworthy. An important and cost-efficient method for more accurately estimating the number, types and location of boats could be an in-depth interview study based on the Transport Agency's Boat Life survey, starting in 2025 (Virgin, et al., 2023). To supplement the interview study, methods could include aerial photography combined with artificial intelligence (AI) for interpretation and validation. This could strengthen the method development for future purposes, and could ensure that the knowledge gathered is produced scientifically. Another innovative survey method would be using satellite images to detect suspended particles in the water column, indicating wreck sites. This method has been successfully used to identify several wrecks off the coast of a Belgian port city.

Accidentally or intentionally sunk recreational boats, known as 'wrecks of recreational boats', can be identified in sea surveys carried out by the Maritime Administration. The Administration's current surveys are financed by fees from commercial shipping, and focus on very busy fairways, rarely covering less busy or shallower areas around jetties or marinas. The Administration has sought funding to conduct surveys in the coastal zone.

SwAM proposes that the Maritime Administration should be commissioned to conduct a coastal zone survey, in order to survey shallower coastal areas and to analyse data to investigate and more accurately estimate the number of recreational boat wrecks in Swedish waters.

5.3.1.2 Quantifying environmental problems

The Swedish Agency for Marine and Water Management proposes obtaining increased knowledge about the environmental impacts of recreational boats.

The survey and the investigation regarding environmental impacts from a lifecycle perspective have pointed out several knowledge gaps and insecurities (Virgin, et al., 2023). The number of derelict and abandoned recreational boats is not fully known, and nor are the environmental risks they pose. Based on the survey, SwAM proposes that more studies on environmental effects should be carried out. This work should focus on further increasing knowledge about:

- » Decomposition processes and the effects of abandoned boats, especially boats in water or partly or fully sunken boats.
- » Emissions of microplastics from recreational boats.
- » Estimates of the amount of hazardous substances such as TBT and heavy metals (copper, zinc, lead and cadmium) on boat hulls or in materials used in recreational boats.

- » Impacts of abandoned boats on seabed and lake bottom life, specifically in sensitive habitats.
- » Effects of boat design, including electric engines and environmental impacts from batteries.

5.3.1.3 Developing recycling methods

The Swedish Agency for Marine and Water Management proposes that the forthcoming results from the government mandate to the Energy Agency¹⁵ should be used as a foundation to increase recycling and reuse of plastics from recreational boats.

Thermosetting plastic composites are present in both recreational boats and wind turbine rotors, combining to constitute a large plastic flow. The need to deal with this waste is expected to increase in Sweden due to growth in wind energy and approximately 9,000–17,000 recreational boats being expected to reach end-of-life each year. This means that Swedish recreational boats may generate 7,000–13,000 tonnes of composite waste annually. With such large flows, more knowledge is needed together with technology and infrastructure to bring about an increase in recycling and reuse.

In the regulatory letter to the Energy Agency for the budget year 2023, the Agency was mandated to “investigate how solar panels and wind turbine rotors could be addressed to a greater extent in a non-toxic and circular manner according to the waste hierarchy” (Regeringskansliet, 2023). The waste hierarchy is the basis for regulation and politics on the prevention and management of waste:

- a) Prevention
- b) Preparation for reuse
- c) Recycling of material
- d) Other recycling, such as energy recycling
- e) Disposal

RISE, Sweden’s research institute and innovation partner, supports the Energy Agency in the government mandate. RISE has previously studied a chemical recycling solution, solvolysis, which may contribute to increased knowledge about how wind turbine rotors can be recycled to a greater extent.

“The goal is to reuse the recycled fibreglass and chemical building blocks from plastic in new products. Fibreglass can have a new life as fibre reinforcement in composites or as raw material in cement, insulation and glass. The chemical building blocks can be used to make new thermoplastics and thermosetting plastics, or as fuel in petrol. In this way, we can reduce our dependence on fossil oil and ensure increased use of current material resources” (RISE, 2020).

Another challenge in connection with recreational boats is identifying a market for the recycled materials, since hazardous substances like TBT and heavy metals such as copper, zinc and lead from anti-fouling paint may be present. SwAM proposes investigating how the presence of hazardous substances from anti-fouling affects the opportunities for safe material recycling, and how these opportunities can be improved by developing methods to separate out hazardous substances.

¹⁵ Cirkulärt omhändertagande av solcellspaneler och vindturbinblad till vindkraftverk.

SwAM also proposes that the forthcoming results from the Energy Agency's government mandate should be used as a foundation on which to develop greater circular management of recreational boats made of plastic, in a non-toxic and circular way in accordance with the waste hierarchy. It is also proposed that the results should be used as a basis for developing a long-term recycling system for recreational boats.

Measures within the management and recycling of the plastic waste flow can increase the value of this waste and encourage design for circular reuse.

5.3.1.4 Circular design: Recyclable boats

The Swedish Agency for Marine and Water Management further proposes that the Chemicals Agency's Government mandate¹⁶ should be used as a foundation for the further investigation of recyclable plastics in the production of recreational boats, and that the Transport Agency should be commissioned to work for demands placed on material choices to be included in the Recreational Craft Directive.

To reduce the amount of plastics in our seas and in nature, and to increase the recycling of recreational boats, plastics need to be recyclable to start with.

"Fossil-based plastics need to be replaced with materials with less climate impact, and we need to identify the value of plastics so that the recycling of materials is increased, and the leakage of plastics decreases" (Naturvårdsverket, 2022).

A predominant share of the up to 400,000 recreational boats in Sweden that could be derelict and need of recycling are made from plastic in the form of glass fibre reinforced polymer (GFRP). Thermosetting plastics, a polymer made of cross-linked molecules in a three-dimensional network, are challenging to recycle. The molecular chains are so strongly connected that they cannot be separated through heating. Thus, thermosetting plastics cannot melt or be transformed into new products. It is possible, however, to grind thermosetting plastics mechanically into chippings or powder that can be used as a filler or a reinforcement in new products. The recycling opportunities are limited, and alternatives to mechanical material recycling are needed (Naturvårdsverket, 2021).

The Chemical Agency has been mandated during 2021–2022 with strengthening the work for a non-toxic circular economy in Sweden, within the EU and globally. As part of the government mandate *Non-toxic from the start*, the Chemical Agency has worked with phasing out especially hazardous substances, decreasing the risk from other hazardous substances, introducing non-toxic design and production, developing supervision, and providing information and guidance.

Within this mandate, the Chemical Agency has been commissioned to investigate which substances present obstacles or are problematic within plastic recycling. This part of the investigation shall be reported on to the Government by 1 November 2023. SwAM proposes that the results of the Chemical Agency's government mandate should represent a point of departure for further research into which substances from recreational boats present obstacles or are problematic within plastic recycling.

¹⁶ Gifträtt från början.

SwAM further proposes that, based on these results, the Government should commission the Transport Agency to work to include demands on material choices and descriptions of recycling recreational boats in the Recreational Craft Directive (2013/53/EU). The goal is that the same demands should apply to all boat producers within the EU.

5.3.2 *Developed cooperation*

The Swedish Agency for Marine and Water Management proposes that the Government appoints an agency to initiate the work to develop cooperation between stakeholders regarding recreational boats.

To deal with many of the measures proposed in this government mandate – such as an investigation into a national register of recreational boats, an EPR scheme and developing recycling methods and reuse, as well as material choices – SwAM proposes that an agency appointed by the Government should be commissioned to bring together all relevant stakeholders.

One method for succeeding with this could be Smart Policy Development (*smart policyutveckling*). This is an initiative from Vinnova, Sweden's innovation agency, that employs innovative ways of developing policies, rules and means of control. The method is suitable in complex challenges where cooperation between stakeholders is needed to produce accessible regulation and policy. The idea is to apply a user-centred working method and to involve stakeholders and their expertise at an early stage. In this way, many of the potential corrections needed in traditional policymaking can be avoided by involving stakeholders in policy development.

The proposal to initiate a smart policy process for recreational boats builds upon previous positive experiences of Smart Policy Development in the work on an EPR scheme for fishing gear made of plastics (SPIRAL). This was an innovation project in which SwAM and the Environmental Protection Agency wished to try out new working methods. The SPIRAL project gave all stakeholders – such as agencies, municipalities, producers, trade and industry, and citizens – the opportunity to cooperate and develop together.

SwAM thereby believes that Smart Policy Development can give a nuanced image of the preconditions for recreational boats, as well as using time and resources sustainably.

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